



# MEDICAL CLASSICS

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NO. 1



## Rhazes

### BIOGRAPHY

- 850 ? Born at Rai or Rayy (Rhages), the principal city of the northeast part of the province of Jibal, Persia. Studied philosophy under the famous Al-Balkhi and became proficient in poetry and music. Wrote an encyclopedia of music, *Fi jumali-l-Musiki* and was a skilled lute player and singer.
- 880 ? Age 30. Traveled to Baghdad where he became interested in medicine. On a visit to the "Azudi" hospital, he saw a patient whose painfully infected arm had been cured by the application of a certain plant. Congenital deformities so intrigued him that he decided to study medicine. Became administrator of the hospital at Rayy (Rhages) and later was selected from among 100 competitors to take charge of the reconstruction of the "Azudi" hospital. (The name "Azudi" was given at a later date.)
- 902 ? Age 52. Became physician (in-charge) of the "Azudi" hospital in Baghdad. Traveled widely but spent most of his time in Persia because it was his birthplace. He attended most of the kings of his time and practically all of the nobles of the Persian court. He wrote many books on medicine, surgery, anatomy, physiology, materia medica, dietetics, hygiene, therapeutics, chemistry, philosophy, psychology, mathematical science, logic, ethics, metaphysics, religion, grammar, music, chess and draughts.
- 923 Age 73. Died, either at Baghdad or Rayy, details having

been lost. Was blind because of cataracts for several years before his death but refused operation.

Muhammad b. al-Hasan wrote that Rhazes was "a man with a large head" and that "he suffered from a moistness of the eyes owing to excessive fondness for eating beans". The same authority states that Rhazes was courteous and affable to everyone, and exceedingly kind to the poor, upon whom he used to bestow bountiful allowances and gratuitous medical attendance, and made no distinction of rank or position in his patients. (Ranking)

### BIBLIOGRAPHY

The compilation of a bibliography of Rhazes is a complicated task. Although he wrote about two hundred and thirty-two works, most of them have been lost. Those preserved are scattered far and wide. Several of them were printed before 1500 and are the rarest of incunabula. All of the printed works have gone through numerous editions. The enthusiasm, intelligence and perseverance of a Janet Doe is needed to compile a complete list of Rhazes' writings, just as she did of the works of Ambrose Paré.

In the lists of Rhazes' writings herein published, an attempt at correlation has not been made. The first list is made up of the books which are to be found in the Army Medical Library in Washington. The second list was compiled by George Jackson Fisher and can be found in *Annals of Anatomy and Surgery*, 6: 225-226, 1882. The third list, noting the manuscripts, was compiled by Solomon Negri, a priest of the Greek Church, who died in the year A. D. 1729. The list was corrected by George S. A. Ranking and published in *Proceedings of the XVII International Congress of Medicine*, 1913, London, 23: 237-268 (246-268), 1914.

### IN ARMY MEDICAL LIBRARY

Liber de secretis i(n) medicina q(ui) liber apho(rismorum) appellatur. In: Janus Damascenus. *Amphorismi*. sm. 4°. (Bononie, 1489.)

Opera parva Abubetri filii Zachariae filii Arasi quae in hoc parvo volumine continentur sunt: Liber ad Almansorem decem tractatus continens cum nonnullis additionibus interlineari-bus Gerardi Cremonensis nusquam antea impressis. Trac-tatus de aegritudinibus juncturarum. De morbis puerorum. Aphorismorum ejusdem libri sex. Parvum antidotarium ipsius. Tractatus de praeservatione ab aegritudine lapidis. Liber introductorius parvus in medicina. De sectionibus et cauteriis ac ventosis. Synonyma ejusdem. Liber divi-sionum cum novem capitibus in fine additis, et ab aliis im-pressoribus semper obmissis: quibus operibus additus est Constantini Monachi viaticus. 7 p. 1., cclxxxiiii ff. 18°. (In fine:) Impress Lugduni, impensis J. de Ferrariis: alias de Politis: ac Vincentii de Prothonariis, 1511.

Centum egritudinum particularium, a capite usque ad pedes, hominibus advenientium, ultime curationes; maxime neces-sarie a Rasi nono Almansoris tradite. Taliter nunc ordinate. Ut cito inveniantur, ut faciliter intelligantur, ut prompte memorentur, hac nova impressione emittuntur. 44 l. 12°. (Papie, B. a Garaldis, 1517.)

Tractatus nonus ad regem Almansorem, de curatione morborum particularium: opusculum huic saeculo accommodatissimum. 56 ff. 16°. Parisiis, apud S. Colinaeum, 1534.

Abubetri Rhazae Maomethi, ob usum experientiamque multi-plicem, et ob certissimas ex demonstrationibus logicis indica-tiones, ad omnes praeter naturam affectus, atque etiam propter remediorum uberrimam materiam, summi medici opera exquisitoria . . . per Gerardum Toletanum, Andream Vesalium, Albanum Torinum latinitate donata . . . 24 p. l., 590 pp., 1 l. fol. Basileae, in off. H. Petri, 1544.

Razae, libellus de peste. De graeco in latinum sermonem versus per Nicolaum Macchellum. 25 ff. 16°. Venetiis, A. Arrinabenum, 1556.

(The same.) Traicté de la peste, et de sa guérison, première-ment escrit en langue Syrienne; interprété en Grec, par Alexandre Trallian, et nouvellement traduit de Grec en François, par M. Sebastian Colin. Plus: Une épitomé, contenant les causes, remèdes, et préservatifs de la peste,

composé par le dit Colin. Aussi une briefve exposition de certains mots, rencontrés en traduisant cet auteur, laquelle a semblé estre nécessaire, pour avoir plus facile intelligence de cette traduction. Avec un traité contenant le régime et façon de vivre, utile aux amateurs de leur santé: composé par le dit Colin. 49 l. 12°. Poitiers, E. de Marnef, 1566.

De febris. In: Febris (De) opus sanc aurem, (etc.) fol. Venetiis, 1576, 99b-105.

De variolis et morbillis, arabice et latine; cum aliis nonnullis ejusdem argumenti. Cura et impensis Johannis Channing. xiv, 276 pp. 8°. Londini, G. Bowyer, 1766.

(The same.) De variolis et morbillis latine. Annexis quibusdam aliis argumenti ejusdem, interprete, et curante quondam Joanne Channing. Ed. J. C. Ringelroig. 6 p. l., 3-130 pp. 12°. Gottingae, sumt. V. Bossiegelii, 1781.

(The same.) Treatise on the small-pox and measles. In: Mead (R.) Med. works. 4°. Lond., 1762, pp. cccli-ccclv, 357-389.

(The same.) A treatise on the small-pox and measles, by Abú Beér Mohammed Ibn Zacaríyá Ar-Rází (commonly called Rhazes). Transl. from the original Arabic by William Alexander Greenhill, M.D. vii, 212 pp. 8°. London, The Sydenham Society, 1848.

(The Same.) Transl. by Leclerc and Lenoir, in: Gaz. méd. de l'Algérie, Alger, 1864, ix, 33; 68; 82; 93; 105; 117; 128; 137: 1865, x, 10; 21; 33; 46.

(The same.) Über die Pocken und die Masern. Aus dem Arabischen übersetzt von Karl Opitz. 39 pp. 8°. Leipzig, J. A. Barth, 1911.

(Tractatus x. medici. Ejusdem liber divisionum et alii tractatus. Experimenta Galieni et Hippocratis opuscula aliquot et aphorismi Joannis (Mesue) Damasceni. Register et versus Maselli Veniae Beneventani praeced. Ne timeas aeger morbo quocunque labores, etc. (In fine:) Impressum Mediolani per prudentes opifices Leonardum Pachel et Videricum Seinzenceller Teuthonicos anno a nativitate Domini millesimo quadringentesimo octuagesimo primo. xvi kalendas Martias.) 216 l. fol. Mediolani, 1481.

Liber dictus Elchavi i.e., Compectens omnia quae ad medicinam spectant. (F. 1<sup>a</sup>.) Joannes Britannicus Brixianus magnifico et splendidissimo comiti Petro Gambeiensi salutem. (F. 1<sup>b</sup>.) Incipit prologus libri elhanti i. totum continentis Bubikir Zacharia errasis filij. (F. 2<sup>a</sup>–3<sup>b</sup> tab. F. 4<sup>a</sup> (c. sig. a.):) ( ) N. nomine Dei misericordis et Miseratoris Laus sit uni Deo glorioso. 278 l. fol. (Brixiae, 1486.)

Almansoris liber nonus cum expositione Sillani. (In fine:) Excellentissimi doctoris Domini Petri de Tussignano Receptae super non Almansoris, feliciter finiunt. Impressae Venetiis jussu et impensis nobilis viri Octaviani Scoti civis modo Venetiensis anno salutis mccccxc, decima die Aprilis. 89 ff. fol. Venetiis, 1490.

Alubekri Arazi filii Zacharie liber incipit: qui ab eo Almansor vocatus est: eo qui regis Mansoris Isaac filii precepto editus est. Verba Abubekri. In: Contenta in hoc volumine. vol. Venetiis, 1497, ff. 1a–112b. Also, in: Ibid. fol. Venetiis, 1508, ff. 2a–112a.

(The same.) 81 ff. fol. Venetiis, per O. Papiensem de Luna, 1497.

De pestilentia. In: Nicephorus logica (etc.). fol. Venetiis, 1498. R. 4a–A 4b.

Continens quisquis es qui antiquiores illos et nunquam satis laudatos auctores in medicinali disciplina sectari studes. En tibi liber quem in medicina editit Abucbare filius Zachariae Rasis, vir qui nulli perfecto inter arabas auctores auctoritate, doctrina, judicio, aut experientia fuit secundus. Hunc Helcbany, hoc est continentem appellavit: quia omnem fere medicinalem artem contineret. In eo enim quaecunque a priscis illis tam graecis quam arabibus auctoribus annotatu digna in medicina sunt sparsim conscripta, collecta, congestaque in unum comperies: ita ut nequaquam possit eruditus medicus haberi qui hunc librum non per ligerit. Ibitur emere ne pigeat. Habebis nunc emendatissimum: diligenti enim studio et lima denuo corrigi curavimus et non minori imprimi. (In fine:) Et sic est finis libri. 12. continentis. Ad laudem Dei Amen. 7 p. l., 254 ff. fol. (Venetiis), 1529.

- (The same.) Rhazes's treatise on the small-pox and measles. In: Mead (Richard). The works of . . . 8°, London, 1756, iv, 109-204.
- (The same.) Rhazis de variolis et morbillis commentarius. Ex Arabico Latine redditus: In: Mead (Richardus). Opera omnia. 8°. Parisiis, 1757, i, 351-410.
- (The same.) Traité de la variole et de la rougeole. Traduction française par Leclerc et Lenoir. 58 pp., 1 l. 8°. Paris, J.-B. Baillière, 1866.
- Also: Gaz. méd. de l'Algérie, Alger, 1864, ix: 1865, x.
- (The same.) Kniga ob ospīc i kori. (Book on small-pox and morbilli.) In: Gubert (V. O.) Sanitas publica. Ospa i ospoprivivaniye. roy. 8°. S.-Peterburg, 1896, i, 25-60.
- Excerpta quae ad aquas et balnea pertinent. In: Balneis (De) omnia quae extant (etc.). fol. Venetiis, 1553, ff. 309-321.

## LIST II

- Compiled by George Jackson Fisher and published in *The Annals of Anatomy and Surgery*, 6: 225-226, 1882. (With additions)
- Continens: The first edition, which is very rare, Brixiae, 2 vols., fol., 1486. Venet., 2 vols., fol., 1500. Venet., 2 vols., fol., 1506. Venet., 2 vols., fol., 1509, 1511, 1542.
- Liber ad Almansorem: Mediolani, fol., 1481. Venet., fol., 1494. Venet., fol., 1497. Venet., fol., 1500. Lugduni, 8°, 1510. Basiliae, fol., 1544.
- Divisio Morborum: This was published together with the Liber ad Almansorem and the other smaller works of Rhazes.
- De Variolis et Morbilis:
- 1498 fol. Venetiis, per Simonem Papiensem.
  - 1528 4°. Parisiis, apud Simonem Siluium.
  - 1529 8°. Parisiis (according to Haller).
  - 1529 small 8°. Basileae, in aedibus Andreae Cratandri.
  - 1544 fol. Basileae, in officina Henrichi (sic) Petri.
  - 1548 fol. Lutetiae (Paris), ex officina Rob. Stephani.
  - 1549 8°. Argentorati, ex officina Remigii Guidonis.
  - 1555 8°. Venetiis, apud Hi. Scotum.

- 1555 8°. Patavii (according to Haller).  
 1555 small 8°. Venetiis, apud Andream Arriuabenum,  
 ad signum Putei.  
 1556 small 8°. Venetiis, apud Andream Arriuabenum.  
 1566 small 8°. Poitiers.  
 1570 8°. Argent., (according to Choulant).  
 1586 8°. Venetiis, (according to Fabricius).  
 1747 8°. Londini, prostant apud Joannem Brindley.  
 (1747) 8°. London, printed for John Reason.  
 1748 8°. London, printed for John Brindley.  
 1748 8°. Goettingae, ex officina Abram. Vanderhoeck.  
 1751 8°. Parisiis.  
 1752 4°. Neap., (according to Haller).  
 1756 8°. London. (Translator's name is not mentioned.)  
 1757 8°. Parisiis, apud Gulielmum Cavelier.  
 1758 4°. Neap., (according to Haller).  
 1762 4°. London, printed for C. Hitch and L. Hawes.  
 1762 8°. Augsburg, (according to Haller).  
 1763 8°. Edinburgh, 3 vols.  
 1765 12 mo. Ibid.  
 1766 8°. Londini, excudebat Guilielmus Bowyer.  
 1767 8°. Dublin.  
 1768 12 mo. Paris, 2 vols.  
 1772 8°. Lausannae, sumptibus Franc. Grasset & Socior.  
 In the 7th volume of Haller's *Artis. Med. Principes*.  
 1774 8°. Bouillon, 2 vols.  
 1775 8°. Edinburgh, printed for Donaldson and Elliot.  
 1781 8°. Goettingae.  
 1787 8°. Lausannae, apud Jul. H. Pott (according to  
 Choulant).  
 1848 8°. London, translated by W. A. Greenhill.

## LIST III

Compiled by Ibn Abi Usaibia in his *Uyunu-l-Anba fi Tabaqati-l-Atibba*, together with the list as given by Salomon Negri (d. 1729) in his MS. translation of this work, and corrected by G. S. A. Ranking and published in *Proceedings of the*



XVII International Congress of Medicine, 1913, London,  
23: 237-268 (246-268), 1914.

1. Liber collectaneorum dictus Complectens. Estque omnium ipsius librorum de arte medica praestantissimus atque maximus, quia in eo collegit quidquid invenerit dispersum circa cognitionem morborum et eorumdem curationem, ex omnibus antiquorum et Medicina libris et eorum qui post illos prodierunt usque ad ipsius aetatem, et quidquid in eo congegit ad suum quemque authorem retulit: quamvis supremum obierit diem, nec per fatum illis licuerit librum hunc describere.
2. Liber Demonstrationis in duos Tractatus. I. septemdecim. II. duodecim continet sectiones.
3. Liber de medicina Spirituum—dicitur quoque Medicina animorum; scopus ejus in eo est morum animae emendatio correctioque et in viginti sectiones est dispositus.
4. Liber quod homo habeat conditorem ac opificem demonstrationes ex Anatomia desumptae et ex utilitate et usu membrorum quae probant fieri non posse ut hominis natura conditione casu existat.
5. Liber de Universalibus sive de rerum existentia. Scopus ejus in eo est ut sit Introductio ad scientiam naturae, et ut facilem reddat intelligentiam sensuum dispersorum in libris de natura conscriptis.
6. Liber Isagoge estque introductio ad logicam—Summa sensuum Categoriarum—Summa sensuum libri de Interpretatione—Summa libri Analyticorum primi et complexio Syllogismorum.
7. De forma Mundi. Scopus ejus in eo est ostendere terram esse sphaericam eamque in medio orbis caelestis, atque hunc duobus polis praeditum super illos circumvolvi: Solem terra majorem Lunam Sole minorem: et quae sequuntur in ejusmodi argumento.
8. Liber adversus insignes Mathematicos quibus usu venit Mathematicam artem praeferre aliis quibusque et in eo praestantiam illius artis et utilitatem demonstrat confutatque illos qui eam supra modum extollunt.

9. Tractatus de causa cur ventus fervens interficiat pleraque animalia.
10. Liber de iis quae seipsum inter et Sissum El-Methani evenere, in eo intendit ostendere absurditatem illius propositionum et pravitatem ejus regularum. In septem disputationibus.
11. Liber de Voluptate: mens ejus est in eo probare illam quiete contineri.
12. Dissertatio sive Tractatus de causa ob quam fit ut Autumnus in morbum conjiciat et vernum tempus contra eo quod Sol in his duabus tempestatibus sit in eodem circumeundi loco. Scripsit illum pro Notariis quibusdam.
13. Liber de discrimine inter somnia praemonentia et alia somniorum genera.
14. Liber de dubiis et contradictionibus quae inveniuntur in Galeni libris.
15. Liber de qualitate Visuum: in eo demonstrat quod visus non sint per radium qui prodeat ex oculo; et dissolvit aliquas figuras ex libris Euclidis qui opticam attingit.
16. Liber Responsio as El-Nashi in quaestionibus decem quibus voluit evertere Medicinam.
17. Liber de Podagra, Ischiade et Arthriti et est in duodecim capita divisus.
18. Liber alius parvus de Arthriti.
19. Libri duodecim de Arte Medica.
20. Primus. Introductio ad Doctrinam.
21. Sec. Introductio ad Demonstrationes.
22. Tert. De Probationibus.
23. Quart. De medicatione et modo tractandi.
24. Quint. De ciborum abstinencia.
25. Sext. De Elixir in decem capita.
26. Sept. De praestantia et nobilitate artium sive Al-Chymiae sive Medicae.
27. Oct. De ordinatione.
28. Non. De regiminibus sive de dieta.
29. Dec. De rebus cognitis perspectisque et de solutione Aenigmatorum vel Allegoriarum.
30. Undec. De Amicitia vel Amore.

31. Duodec. De Technis.
32. Liber de Al-Chymia quod ars illa propior sit ad possibile quam ad impossibile.
33. Liber de lapidibus (Philosophicis) in eo declarat illam rem qua fit hoc opus.
34. Liber mysteriorum.
35. Liber arcanum arcanorum.
36. Book on Classification.
37. Epistola singularis seu privata.
38. De lapide Croceo Philosophorum.
39. Liber Epistolarum Regum.
40. Liber. Responsio ad Philosophum el-Kendi eo quod artem al-Chymiae in impossibili posuerit.
41. Liber. Quod abstinentia modum excedens et properatio ad remedia et avocatio ab alimentis non servant valetudinem sed morbos adferant.
42. Tractatus quod medicorum imperiti durius constringant aegros cum interdicut illis appetitus eorum; et quod nullus sit in homine major morbus quam ignorantia et temeritas.
43. Liber. De Vitiis medicorum sive de ipsorum vivendi ratione et moribus.
44. Dissertatio quod Lutum translutum contineat utilitates. Scripsit illam in gratiam Abi Hazim iudicis.
45. Dissertatio de Variolis et Morbillis in quatuordecim capita.
46. Dissertatio de calculis in renibus et vesica.
47. Liber pro eo qui medicum in promptu non habet. Est etiam mens ejus explicare morbos et amplificare de iis sermonem; in eo enim singulos recenset morbos et possibile esse asserit illos curari per obvia remedia. Appelatur quoque his liber, Medicina Pauperum.
48. Book on Medicines which are to be found in every house.
49. Liber. Responsio sive Confutatio libri a Giahezo conscripti de evertenda Medicina.
50. Liber contradictionibus Giahezi in libro suo de metaphysica et de iis quae Philosophis perperam attribuit.
51. Book of Divisions and Branches (of diseases and their causes and treatment).

52. Liber. De medicina Regia. In eo meminit de morbis et curatione omnium morborum per victum et de abdendis in alimentis, necessitate id exigente, medicamentis atque in iis maxime quae non abhorreat aegrotans.
53. Liber. De Paralysi seu Hemiplexia.
54. Liber. De morbo faciei, sive de tortura oris et Convulsione Canina.
55. Liber de forma Oculi.
56. Liber. De forma Hepatis.
57. Liber. De forma testium.
58. Liber. De forma cordis.
59. Liber de forma meatus auditorii.
60. Liber de forma articulorum corporis.
61. Liber de medicamentis compositis sive Antidotis.
62. Liber de acceptione paratae pecuniae et de Chirographo adversus sectam Motazelitarum seu Schismaticorum.
63. Liber. De cucumeri amaro.
64. Liber. De qualitate Nutritionis estque summa recensionis medicamentorum mineralium.
65. Liber. De usu remediorum compositorum.
66. Liber. De proprietatibus Rerum.
67. Liber maximus de Hyle sive de Materia prima.
68. Liber de statione terrae in medio orbis caelestis gyros ducendo.
69. De evertenda Medicina adversus Ali b. Ettemar.
70. Liber. Quod fieri non possit ut mundus existat nisi eo quo illum spectamus modo.
71. Liber de Motu quod non sit ordinatus sed cognitus et certus.
72. Dissertatio quod corpori infit commotio a se ipso et quod motus sit principium naturale.
73. Poema sive Carmen. De rebus Logicis.
74. Poema sive Carmen de Scientia Divina, sive Metaphysica vel Theologia.
75. Carmen de Exhortatione Graeca.
76. Liber de Sphaeris et mensuris compendiosis.
77. Liber de declaratione morbi in quo pellitur sitis victu et nonnunquam medicatione.

78. Liber de religatione ossium fractorum et quomodo conquiescat illius dolor et quodnam in eo sit signum caloris frigorisve.
79. Dissertatio de causis quae pleurorumque hominum animos a praestantissimis ad viliores quosque medicos solent deflectere.
80. Dissertatio de eo quod in alimentis et fructibus praeferrri aut postponi debet.
81. Dissertatio et responsione ad Ahmetum bin Et-Tabib Essargiali (sic) ad ea praesertim quibus confutavit Galenum de gustu amaro.
82. Liber. De Responsione ad El-Massmai Metaphysicae professor (sic) in confutatione sua adversus Materiae primae patronos.
83. Liber. De Spatio quod est tempus et de vacuo et pleno quae ambo locum constituunt.
84. Dissertatio in qua ostendit culpam alicujus medici (the physician Jarir) cum negasset consilium dare principi Ahmet Ben Ismail de comedendis moris nigris post pepones in certo casu as simul ipsum expurgat excusatque.
85. Liber de confutatione explicationis Porphyrii cum exponit sententiam Aristotelis de Metaphysica.
86. Liber de Metaphysica.
87. Liber de Materia prima universali auri Minera (sic).
88. Liber Abul Kassim El-Balkhi adjecta ad illum responsione et responsionis responsio.
89. Liber de Metaphysica secundum Platonis sententiam.
90. Liber. Responsio ad Abul Kassim El-Balkhi circa ea in quibus sibi ipsi contradicit in duabus disputationibus de Metaphysica.
91. Liber. De probatione auri et argenti et de ponderenaturali.
92. Liber. De Constantia in Sapientia.
93. Liber. Apologia eorum qui sese in Latrunculorum ludo occupant.
94. Liber. De arcano ludi Latrunculorum.
- 94a. Liber. De peritia palpandi pulsus.
95. Liber. Quod existat mundi creatur (sic) isque Sapientissimus.

96. Liber de Coitu, in eo declarat temperamenta et utilitates coitus noxasque.
97. Liber. Additamenta ad librum De Coitu.
98. Liber El-Mansuri dictus, composuit eum in gratiam Mansur bin Isaac bin Ismail bin Ahmad Chorassani Domini.
- 98a. Tractatus quem ad librum El-Mansuri adjecit, estque de rebus naturalibus.
99. Liber Collectionis et appellatur Artem medicam concludens.
100. Liber de Praestantia et Decore Medicinae.
101. Liber de causa cur reflecta de corpore particula ita ut ab illo sejungatur eidem non adhaerent (sic) quantumvis sit parva, in vulneribus maximis illae partes quae sejunctae non fuerint adhaereant corpori licit sint multo majores.
102. Epistola de Aqua nive refrigerata et de illa quae non injecta nive, atque de ea quae ebullitur et postea gelu et nive refrigeratur.
103. Liber de causa propter quam fit ut piscis recens sitim excitet.
104. Epistola. Quod non reperiatur vinum non inebrians: in ea observat omnes effectus vini inebriantis et corpori convenientis.
105. Liber. De indiciis felicitatis Imperii.
106. Liber. De praestantia oculi seu visus super ceteros sensus.
107. Epistola. Quod occasus Solis et ceterorum Planetarum ut et eorum ortus non sit ob motum terrae sed fiat per motum orbis caelestis.
108. Liber de Logica, in eo refert quidquid ex eo scitu necessarium est, idque locutionibus Metaphysicorum Muslimorum.
109. Liber de evertenda opinione eorum qui putant Planetas non esse in extrema circumitione et de aliis ad id argumentum pertinentibus.
110. Liber. Quod illi qui ignorant demonstrationem terram esse sphaericam hominesq: circum illam non possint animo recipere illius formam.
111. Epistola. In qua disquirat de terra naturali an sit lutum an lapis.
112. Liber in quo declarat compositionem (corporum) duobus fieri modis et alia ejusmodi.
113. Liber. De consuetudine sive habitu quod sit naturalis.

114. Dissertatio. De utilitate in extremitate palpebrarum perpetua. (?)
115. Dissertatio. De causa ob quam oculi coarctentur in luce et dilatentur in tenebris.
116. Dissertatio. De causa propter quam existiment imperitissim nive excitari.
117. Dissertatio. De causa propter quam nix urat et lactificet.
118. Liber. De alimentis aegrotantium.
119. Dissertatio in qua dirimit controversiam tum eorum qui corpora in tempore esse condita et eorum qui ab aeterno fuisse dicunt.
120. Liber. Quod morbi quidam exigui difficiliores sint cognitu et curatu, &c.
121. Liber. De causa propter quam vulgus acutissimos quoque Medicos vituperet.
122. Epistola. De morbis difficilibus ac obscuris et de medici excusatione.
123. Epistola. De morbis interimentibus ob maximam illorum vehementiam, et de iis quae de repente in ipso eorum ortu accidunt quae medicus corrigere non potest et de ipsius excusatione in talibus.
124. Liber. Quod medicus acutus non sit ille qui possit omnes curare morbos quoniam hoc non est in hominum potestate nec penes Hippocratis artem.
125. Epistola. Quod artifex omnibus numeris absolutus in quacunque arte non existat nedum in Medicina speciatim: et de causa cur imperiti medici, vulgus et etiam mulieres in civitatibus foeliciores sint in sanandis quibusdam morbis quam viri doctissimi et de excusatione medici hoc propter.
126. Liber. De Probatis et experientia compertis in arte medica: per modum syntagmatis est digestus.
127. Liber. Quod anima non sit materialis et corporea.
128. Liber. De septem Planetis et de Sapientia.
129. Epistola ad El-Hassan bin Isaac bin Moharib El-Kamahi.
130. Liber de animo tenaci ac parco.
131. Liber. De animo magno.

132. Dissertatio. De causa ob quam accidit Coryza sive tenuis per nares distillatio Abi Zaido Balkhensi in tempestate veris cum rosas olfacit.
133. Epistola. De probatione medici et quomodo eum esse deceat quantum ad animum et ad corpus et de ejus vita conversatione et moribus.
134. Epistola. De doctrina stellarum et quantum quis potest cognitione assequi in stellarum scientiis juxta sententiam Philosophorum naturalium &c.
135. Liber. De Causa propter quam somnus oriri facit in quorundam capitibus aliquid simile Coryzae.
136. Liber. De dubiis quae habentur de Barleo.
137. Liber. De explicatione libri Plutarchi seu commentarii in librum Timai.
138. Epistola. De causa creationis ferarum et reptilium noxi-  
orum.
139. Liber. Supplementum ad ea quibus contradixerat senti-  
entiis eorum qui materiam primam oppugnaverant.
140. Liber de causa contradictionis eorum qui seculares seu  
Aiwonii dicuntur et aeternitatem mundi defendunt et  
eorum qui mundi novitatem tutantur.
141. Liber. De confutanda sententia Ali ben Shahid Balkhensis  
qui ipsi contradixerat in questione de voluptate.
142. Liber. De diebus exercitii.
143. Liber. De defectu mensurae in dignitate Antistitum  
Religionis.
144. Quod non detur quies et separatio simul.
145. Liber. Supplementum libris Plutarchi.
146. Liber. De confutando libro 'De regimine et De Diaita'.
147. Compendium libri Galeni de technis adhibendis ad sa-  
nandum.
148. Compendium libri majoris Gaieni 'De pulsu'.
149. Expositio libri Galeni de morbis et accidentibus.
150. Expositio libri 'De morbis dolorem incutientibus' (of  
Galen).
151. Liber. De discretione opinionum adversus sectam Mota-  
zileh sive Schismaticorum.



152. Liber. De confutatione libri a Balkho scripti.
153. Liber. Confutatio libri Balkhensis 'De Metaphysica' et ad ipsum responsio.
154. Liber. Quod detur existentia et continuatio et non detur esse motum et continuationem qui non desinant.
155. De Quadrato in Mathesi Epistola.
156. De Dissidiis et sententiis Philosophicorum (sic) Metaphysicorum.
157. Liber. De optimo vivendi genere et de morum urbanitate.
158. Liber. De necessitate precationis.
159. Liber. Summa Metaphysicae.
160. Epistola. De Metaphysica elegantissime.
161. Liber. De utilitatibus alimentorum et de repellendis ipsorum noxis, in duos tractatus: in primo recenset ea quae ciborum noxam expellunt et indigestionem ac gravationem amoveant omni tempore in omni temperamento et in omni statu.
162. Liber. De apertione alterius vitae, scopus ejus in illo est evertere sententiam eorum qui alteram vitam faciunt irritam, probareque esse alteram vitam.
163. Liber. De causa cur lapis Magnes ferrum attrahat, et in eo habetur multa oratio de vacuo.
164. Liber major de Anima.
165. Liber minor de Anima.
166. Liber. Trutina intellectus.
167. Liber de potu inebriante in duos tractatus.
168. Tractatus de Oxymele et ejus utilitatibus et noxis.
169. Liber. De dolore Colico.
170. The small book on Colic.
171. Liber. De explicatione libri Galeni de Aphorismis Hippocratis.
172. Liber. De pruritu in anu et de curando atque indicando.
173. Liber. Confutatio libri de existentia a Mansuro ben Talha scripti.
174. Liber. De iis quae vellet manifestare et esse contendit vitiis quae Prophetis et viris sanctis attribuuntur. &c.
175. Liber. De virtutibus Antistitis praestantissimi El-Massum.
176. Liber. De vomitione febricitantium ante maturitatem.

177. Liber de Antistitibus veris.
178. Liber de dotibus discipuli.
179. Liber. De Speculationis conditionibus.
180. Liber. De opinionibus circa res naturales.
181. Liber de errore medici et cur scopum non attingat.
182. Carmina de Scientia Metaphysica.
183. Praescriptum Electuarii cujusdam praestantissimi.
184. Interpretatio libri Philosophi Giaber de Arcanis metricae.
185. Epistola. De Compositione.
186. Epistola. De Grammatica.
187. Epistola. De siti et ob eam caloris augmento.
188. Liber. De summa Musices.
189. Liber. De imaginationibus et animi motibus.
190. Liber. De usu ferri et de ossium fractorum religatione.
191. Liber. De iis quae opinione creduntur.
192. Liber. De iis quae praetermissa sunt Philosophis.
193. Liber Arcani in Sapientia.
194. Liber. De utilitatibus membrorum.
195. Liber Sufficiens in Medicina.
- 195a. Book of the eater of dessert fruit.
196. Liber Compendiosus Antidotum.
- 196a. Liber de Sanatione in eo declarat compositionem esse duplicem; alteram esse compositionem corporum diversis, alteram corporum similibus constantium partibus, nec revera unam esse alteram.
197. Liber. De Sapientia ad Abi'l Kassim ben Dulf.
198. Liber ad Ali ben Wahban, in eo solum habetur caput de sole.
199. Liber. De Sapientia ad Ebn Ali Essanayi.
200. Liber alius De Sapientia.
201. Liber. Arcanum arcanorum de Sapientia.
202. Liber. Arcanum Medicinae.
203. Liber. De praestantia Phlebotomiae. &c.
204. Liber directionis et vocatur Liber sectionum.
205. Liber. Quod in morbis qui determinari atque explicari non possunt, oporteat ut medicus sit assiduus apud aegrotantem et debeat uti experimentis ad illos cognoscendos. Et de medici fluctuatione.
206. Liber Compendiosus de lacte.

207. Sermones circumlati ipsum inter et Massudum de novitate mundi.
208. Liber. Isagoge ad Medicinam.
209. Tractatus de gustibus.
210. Tractus de Leuce seu Vitilagine et Lepra.
211. Liber de Ornatu et Decoro.
- 211a. Book on cure of disease in an hour.
212. Tractatus de haemorrhoides et fissuris in podice.
213. Sermo de divisione et distinctione morborum.
214. Tractatus de exustione in peni et vesica existente.
215. Liber. Medicina pauperum.
216. Epistola ad Wezirum Abi'l Hasan 'Ali bin Isa b. Da'ud b. al-Jarrah al Quana'i de morbis qui corpori extrinsecus accidunt.
217. Epistola ad suum discipulum Iosephum Iacobi filium de remediis oculi et ejus medicandi ratione tum de medicamentorum compositione.
- 217a. Book on Materia Medica.
218. Liber de substantiis corporum.
219. Liber de ipsius vita.
220. Tractatus de Coryza fluxione et repletionem capitis, et de cohibitionem fluxionis ut pectus non attingat, et venti qui nares oberat et halitum per eos impedit.
221. Tractatus de succedaneis quae adhibentur in Medicina inter medicandum, de illorum regulis et de iis utendi ratione.
222. Liber. Nosocomii descriptio.
223. Tractatus brevis de victu.
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## INTRODUCTION

Small-pox or variola, as it is known in scientific terminology, has probably been present in India and China from the dawn of history. Some of the earliest, though vague, descriptions were given by church fathers in the sixth century and by the chronicler, Aaron, in the seventh century. It remained, however, for Rhazes, a physician of Baghdad, in about the year 910, to write the first definite account of the disease. This work which is herein reproduced is one of the classics of the entire medical literature and one of the greatest works that has come down to us from the Arabian School.

The term pox or pocks comes from the Saxon word *pocca*, meaning a pouch. The word small was introduced to distinguish the disease from the Great Pox or syphilis which was widespread in Europe in a vicious form in the early sixteenth century. The scientific term variola is from the Latin word *varus*, a pimple or pustule.

In his work on small-pox Rhazes is the first to differentiate this disease from measles. The author refers to the ancient literature and describes Galen's attitude toward the disease. He describes the symptoms in detail and the points which differentiate measles from small-pox. He describes the treatment fully and gives advice on how to prevent and remove the disfiguration of the pock marks.

In later times John of Gaddesden, physician to Edward II, wrote a notable account of small-pox and described a treatment by employing colored lights. He is supposed to have benefited patients by surrounding their beds with red tapestries. On first consideration, no sense can be seen in this therapy but almost in our own day Niels Finsen, a Nobel prize-winner for his work on heliotherapy, advised placing a patient with small-pox in a room lighted only by dim red lights. The absence of strong illumination or of sunlight lessens the scars or pocks of the disease.

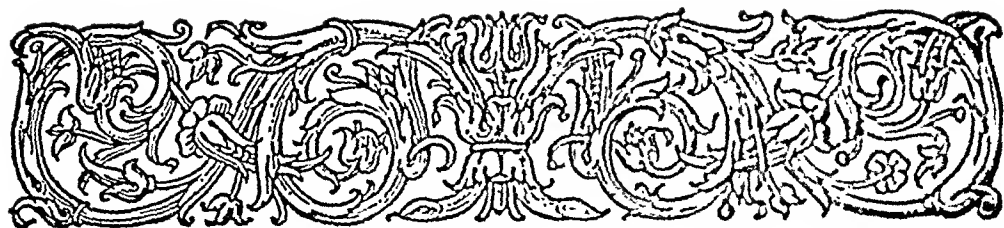
Another famous writer on small-pox was Sydenham who in about 1675 wrote a clear account of small-pox and described symptoms which differentiate it from measles. He attributed small-pox to a specific inflammation of the blood and advised treatment by fresh air and cooling liquids instead of the sweating therapy which was then in vogue. In the time of Sydenham it

was estimated that approximately 400,000 deaths from small-pox occurred each year in Europe and that at least half of the population had the disease.

Control of small-pox by inoculation was probably first practiced by inhabitants of India and the Near East. Inoculation consists of removing matter from a small-pox pustule and inserting it beneath the skin of a normal individual. Usually the resulting case of small-pox is mild, leaves few scars and, of course, protects the patient from a second infection by the disease. About 1674 the practice of inoculation was introduced into Constantinople by the Circassians. In 1717 Lady Mary Wortley Montague, wife of the British Ambassador in Turkey, introduced and popularized inoculation in England where it was first tried on six criminals condemned to death who did well and were liberated.

The second method of control of small-pox is that of vaccination which was introduced by Edward Jenner in 1798. In this procedure matter from a cowpox sore is removed from the hand of a patient who has become infected from a cow and the matter is introduced into the skin of a healthy individual. This person then develops cowpox which is a mild and harmless disease and protects the human body from small-pox. The practice of vaccination soon spread all over Europe and was introduced into America by Dr. Waterhouse with the encouragement of President Jefferson. As long as vaccination is performed, small-pox is controlled, but where a few unvaccinated and susceptible people keep the disease alive small-pox is always likely to extend and become the serious menace which it was 150 years ago.

Thus we see why the first accurate description of small-pox and its differentiation from measles by the Arabian physician, Rhazes, is an important contribution to MEDICAL CLASSICS.



# A Treatise on the Small-Pox and Measles

BY

ABÚ BECR MOHAMMED IBN ZACARÍYÁ AR-RÁZÍ  
(Commonly called RHAZES)

*Translated from the original Arabic by  
William Alexander Greenhill, M.D.*

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(Published in London for the Sydenham Society, 1847)

## PREFACE

**I**N THE name of GOD, the Compassionate, the Merciful.  
Abú Becr Mohammed Ibu Zacaríyá says:—  
It happened on a certain night at a meeting in the house of a nobleman, of great goodness and excellence, and very anxious for the explanation and facilitating of useful sciences for the good of mankind, that, mention having been made of the Small-Pox, I then spoke what came into my mind on that subject. Whereupon our host (may GOD favour men by prolonging the remainder of his life,) wished me to compose a suitable, solid and complete discourse on this disease, because there has not appeared up to this present time either among the ancients or the moderns an accurate and satisfactory account of it. And therefore I composed this discourse, hoping to receive my reward from the Almighty and Glorious GOD, and awaiting His good pleasure.

The plan of my undertaking, and the subject of the chapters is as follows:—

## CHAP. I

Of the causes of the Small-Pox, and how it comes to pass that hardly any one escapes the disease.

## CHAP. II

A specification of those habits of body which are most disposed to the Small-Pox; and also of the seasons in which the disease is most prevalent.

## CHAP. III

Of the symptoms which indicate the approaching eruption of the Small-Pox and Measles.

## CHAP. IV

A specification of the articles of the regimen or treatment of the Small-Pox in general.

## CHAP. V

Of the preservation from the Small-Pox before the symptoms of the disease appear, and the way to hinder the multiplying of the pustules after the appearance of the symptoms.

## CHAP. VI

Of those things which accelerate the pustules of the Small-Pox and their appearance externally, and which assist Nature herein.

## CHAP. VII

Of the care to be taken of the eyes, throat, joints, ears, and those parts of which it is necessary to take care upon the appearance of the symptoms of the Small-Pox.

## CHAP. VIII

Of those things which hasten the ripening of those pustules which can be ripened.

## CHAP. IX

Of the drying of those pustules which are ripened.

## CHAP. X

Of those things which take away the scabs of the Small-Pox and the eschars.

## CHAP. XI

Of those things which take away the marks of the Small-Pox from the eyes and the rest of the body.



## CHAP. XII

Of the regulating the patient's food in the Small-Pox.

## CHAP. XIII

Of the regulating the patient's bowels in the Small-Pox.

## CHAP. XIV

Of the mild and the fatal species of Small-Pox.

## CHAPTER I

OF THE CAUSES OF THE SMALL-POX; HOW IT COMES TO PASS THAT  
HARDLY ANY ONE ESCAPES THE DISEASE; AND THE  
SUM OF WHAT GALEN SAYS CONCERNING IT

As to any physician who says that the excellent Galen has made no mention of the Small-Pox, and was entirely ignorant of this disease, surely he must be one of those who have either never read his works at all, or who have passed over them very cursorily. For Galen describes a plaster in the first book of his treatise *κατὰ γένος*, and says that it is useful against this and that disease, "and also against the Small-Pox." Again, in the beginning of the fourteenth book of his treatise "On Pulses," at about the first leaf, he says, that "the blood is sometimes putrefied in an extraordinary degree, and that the excess of inflammation runs so high that the skin is burned, and there break out in it the Small-Pox and excoriating erysipelas by which it is eroded." Again, in the ninth book of his treatise "On the Use of the Members," says that "the superfluous parts of the food that remain, which are not converted into blood, and remain in the members, putrefy, and become more acid, in process of time, until there are generated the erysipelas, Small-Pox, and spreading inflammation." Again, in the fourth book of "Timaeus" he says that "the ancients applied the name *φλεγμονή* to everything in which there was inflammation, as the erysipelas, and Small-Pox, and that these diseases were in their opinion generated from bile."

(2.) If, however, any one says that Galen has not mentioned any peculiar and satisfactory mode of treatment for this disease, nor any complete cause, he is certainly correct; for, unless he has done so in some of his works which have not been published

in Arabic, he has made no further mention of it than we have just cited. As for my own part, I have most carefully inquired of those who use both the Syriac and Greek languages, and have asked them about this matter; but there was not one of them who could add anything to what I have mentioned; and indeed most of them did not know what he meant by those passages which I have distinctly quoted. This I was much surprised at, and also how it was that Galen passed over this disease which occurs so frequently and requires such careful treatment, when he is so eager in finding out the causes and treatment of other maladies.

(3.) As to the moderns, although they have certainly made some mention of the treatment of the Small-Pox, (but without much accuracy and distinctness,) yet there is not one of them who has mentioned the cause of the existence of the disease, and how it comes to pass that hardly any one escapes it, or who has disposed the modes of treatment in their right places. And for this reason we hope that the reward of that man who encouraged us to compose this treatise, and also our own, will be doubled, since we have mentioned whatever is necessary for the treatment of this disease, and have arranged and carefully disposed every thing in its right place, by GOD's permission.

(4.) We will now begin therefore by mentioning the efficient cause of this distemper, and why hardly any one escapes it; and then we will treat of the other things that relate to it, section by section: and we will (with GOD's assistance,) speak on every one of these points with what we consider to be sufficient copiousness.

(5.) I say then that every man, from the time of his birth till he arrives at old age, is continually tending to dryness; and for this reason the blood of children and infants is much moister than the blood of young men, and still more so than that of old men. And besides this it is much hotter; as Galen testifies in his Commentary on the "Aphorisms," in which he says that "the heat of children is greater in quantity than the heat of young men, and the heat of young men is more intense in quality." And this also is evident from the force with which the

natural processes, such as digestion and growth of body, are carried on in children. For this reason the blood of infants and children may be compared to must, in which the coction leading to perfect ripeness has not yet begun, nor the movement towards fermentation taken place; the blood of young men may be compared to must, which has already fermented and made a hissing noise, and has thrown out abundant vapours and its superfluous parts, like wine which is now still and quiet and arrived at its full strength; and as to the blood of old men, it may be compared to wine which has now lost its strength and is beginning to grow vapid and sour.

(6.) Now the Small-Pox arises when the blood putrefies and ferments, so that the superfluous vapours are thrown out of it, and it is changed from the blood of infants, which is like must, into the blood of young men, which is like wine perfectly ripened: and the Small-Pox itself may be compared to the fermentation and the hissing noise which take place in must at that time. And this is the reason why children, especially males, rarely escape being seized with this disease, because it is impossible to prevent the blood's changing from this state into its second state, just as it is impossible to prevent must (whose nature it is to make a hissing noise and to ferment,) from changing into the state which happens to it after its making a hissing noise and its fermentation. And the temperament of an infant or child is seldom such that it is possible for its blood to be changed from the first state into the second by little and little, and orderly, and slowly, so that this fermentation and hissing noise should not show itself in the blood: for a temperament, to change thus gradually, should be cold and dry; whereas that of children is just the contrary, as is also their diet, seeing that the food of infants consists of milk; and as for children, although their food does not consist of milk, yet it is nearer to it than is that of other ages; there is also a greater mixture in their food, and more movement after it; for which reason it is seldom that a child escapes this disease. Then afterwards alterations take place in their condition according to their temperaments, regimen, and natural disposition, the air that surrounds them, and the state of the vascular system both as to quantity and quality, for

in some individuals the blood flows quickly, in others slowly, in some it is abundant, in others deficient, in some it is very bad in quality, in others less deteriorated.

(7.) As to young men, whereas their blood is already passed into the second state, its maturation is established, and the superfluous particles of moisture which necessarily cause putrefaction are now exhaled; hence it follows that this disease only happens to a few individuals among them, that is, to those whose vascular system abounds with too much moisture, or is corrupt in quality with a violent inflammation; or who in their childhood have had the Chicken-Pox, whereby the transition of the blood from the first into the second state has not been perfected. It takes place also in those who have a slight heat, or whose moisture is not copious; and to those who had the Chicken-Pox in their childhood, and are of a dry, lean habit of body, with slight and gentle heat; and who when they became young men, used a diet to strengthen and fatten their body, or a diet which corrupted their blood.

(8.) And as for old men, the Small-Pox seldom happens to them, except in pestilential, putrid, and malignant constitutions of the air, in which this disease is chiefly prevalent. For a putrid air, which has an undue proportion of heat and moisture, and also an inflamed air, promotes the eruption of the disease, by converting the spirit in the two ventricles of the heart to its own temperament, and then by means of the heart converting the whole of the blood in the arteries into a state of corruption like itself.

(9.) Having thus sufficiently, though briefly and succinctly, treated of the causes of the Small-Pox, we shall now proceed to speak of the habits of body which are most disposed to this disease and to the Measles.

## CHAPTER II

A SPECIFICATION OF THOSE HABITS OF BODY WHICH ARE MOST  
DISPOSED TO THE SMALL-POX; AND OF THE SEASONS IN  
WHICH THESE HABITS OF BODY MOSTLY ABOUND

The bodies most disposed to the Small-Pox are in general such as are moist, pale, and fleshy; the well-coloured also, and ruddy,

as likewise the swarthy when they are loaded with flesh; those who are frequently attacked by acute and continued fevers, bleeding at the nose, inflammation of the eyes, and white and red pustules, and vesicles; those that are very fond of sweet things, especially, dates, honey, figs, and grapes, and all those kinds of sweets in which there is a thick and dense substance, as thick gruel, and honey-cakes, or a great quantity of wine and milk.

(2.) Bodies that are lean, bilious, hot, and dry, are more disposed to the Measles than to the Small-Pox; and if they are seized with the Small-Pox, the pustules are necessarily either few in number, distinct, and favorable, or, on the contrary, very bad, numerous, sterile, and dry, with putrefaction, and no maturation.

(3.) Lastly, those bodies that are lean and dry, and of a cold temperament, are neither disposed to the Small-Pox nor to the Measles; and if they are seized with the Small-Pox, the pustules are few, favorable, moderate, mild, without danger, and with a moderate light fever from first to last, because such constitutions extinguish the disease.

(4.) I am now to mention the seasons of the year in which the Small-Pox is most prevalent; which are, the latter end of the autumn, and the beginning of the spring; and when in the summer there are great and frequent rains with continued south winds, and when the winter is warm, and the winds southerly.

(5.) When the summer is excessively hot and dry, and the autumn is also hot and dry, and the rains come on very late, then the Measles quickly seize those who are disposed to them; that is, those who are of a hot, lean, and bilious habit of body.

(6.) But all these things admit of great differences by reason of the diversity of countries and dwellings, and occult dispositions in the air, which necessarily cause these diseases, and predispose bodies to them; so that they happen in other seasons besides these. And therefore it is necessary to use great diligence in the preservation from them, as soon as you see them begin to prevail among the people; as I shall mention in the sequel.

## CHAPTER III

ON THE SYMPTOMS WHICH INDICATE THE APPROACHING ERUPTION  
OF THE SMALL-POX AND MEASLES

The eruption of the Small-Pox is preceded by a continued fever, pain in the back, itching in the nose, and terrors in sleep. These are the more peculiar symptoms of its approach, especially a pain in the back, with fever; then also a pricking which the patient feels all over his body; a fullness of the face, which at times goes and comes; an inflamed colour, and vehement redness in both the cheeks; a redness of both the eyes; a heaviness of the whole body; great uneasiness, the symptoms of which are stretching and yawning; a pain in the throat and chest, with a slight difficulty in breathing, and cough; a dryness of the mouth, thick spittle, and hoarseness of the voice; pain and heaviness of the head; inquietude, distress of mind, nausea, and anxiety; (with this difference, that the inquietude, nausea, and anxiety are more frequent in the Measles than in the Small-Pox; while, on the other hand, the pain in the back is more peculiar to the Small-Pox than to the Measles;) heat of the whole body, an inflamed colour, and shining redness, and especially an intense redness of the gums.

(2.) When, therefore, you see these symptoms, or some of the worst of them, (such as the pain of the back, and the terrors in sleep, with the continued fever,) then you may be assured that the eruption of one or other of these diseases in the patient is nigh at hand; except that there is not in the Measles so much pain of the back as in the Small-Pox; nor in the Small-Pox so much anxiety and nausea as in the Measles, unless the Small-Pox be of a bad sort; and this shows that the Measles come from a very bilious blood.

(3.) With respect to the safer kind of the Small-Pox, in this it is the quantity of the blood that is hurtful rather than its bad quality; and hence arises the pain of the back, from the distension of the large vein and artery which are situated by the vertebrae of the spine.

## CHAPTER IV

A SPECIFICATION OF THE ARTICLES OF THE REGIMEN OR  
TREATMENT OF THE SMALL-POX IN GENERAL

We will now specify the articles of the regimen or treatment of the Small-Pox in general.

The first of these is the preservation from the Small-Pox before the appearance of the symptoms of the disease, and the way to restrain it after the appearance of the symptoms. Chap. V

The second, of those things which accelerate the eruption and its appearance. Chap. VI

The third, of the care to be taken with regard to the eyes, eyelids, auditory canals, interior of the nose, throat, and joints, so that no putrescence may remain in them. Chap. VII

The fourth, of those things which hasten the ripening of the pustules. Chap. VIII

The fifth, of the hastening of the drying of the pustules. Chap. IX

The sixth, of the taking away the eschara. Chap. X

The seventh, of those things which remove the marks of the Small-Pox. Chap. XI

The eighth, of the patient's food in the Small-Pox. Chap. XII

The ninth, of the preservation of the bowels from diarrhoea after the small-pox. Chap. XIII

The tenth, of the signs of the mild and fatal species of Small-Pox. Chap. XIV

Of all these particles, if GOD permit, I shall speak shortly and sufficiently.

## CHAPTER V

ON THE PRESERVATION FROM THE SMALL-POX BEFORE THE  
APPEARANCE OF THE DISEASE, AND THE WAY TO HINDER  
THE MULTIPLYING OF THE PUSTULES AFTER THEIR APPEARANCE

It is necessary that blood should be taken from children, youths, and young men who have never had the Small-Pox, or

have only had the Chicken-Pox, (especially if the state of the air, and the season, and the temperament of the individuals be such as we have mentioned above,) before they are seized with a fever, and the symptoms of the Small-Pox appear in them. A vein may be opened in those who have reached the age of fourteen years; and cupping-glasses must be applied to those who are younger; and their bed-rooms should be kept cool.

(2.) Let their food be such as extinguishes heat; soup of yellow lentiles, broth seasoned with the juice of unripe grapes, acid minced meat, kid's-foot jelly, the strained liquor of veal broth, broth made of woodcocks, hens, and pheasants, and the flesh of these birds minced and dressed with the juice of unripe grapes. Their drink should be water cooled with snow, or pure spring water cold, with which their dwellings may also be sprinkled. Let them frequently eat acid pomegranates, and suck the inspissated juices of acid and styptic fruits, as of pomegranates, warted-leaved rhubarb, acid juice of citrons, juice of unripe grapes, Syrian white mulberries, and the like. Where the temperament is hot, and there is much inflammation, the patient may take in the morning barley water carefully prepared, to which is added a fourth part of acid pomegranate juice. But if the heat be less, barley gruel and sugar may be given in the morning, and vinegar, lentiles, and especially juice of unripe grapes, may be added to the food; for by means of these you will be able to thicken and cool the blood, so as to prevent the eruption breaking out. This regimen is of great service in all times of pestilence, for it diminishes the malignity of pestilential ulcers, and boils, and prevents pleurisies, quinsies, and in general all distempers arising from yellow bile and from blood.

(3.) In the middle of the day let the patient wash himself in cold water, and go into it, and swim about in it. He should abstain from new milk, wine, dates, honey, and in general from sweet things; and dishes made by a mixture of flesh, onions, oil, butter, and cheese; from lamb, beef, locusts, young birds, high-seasoned things, and hot seeds. When the season is pestilential and malignant, or the temperament is hot and moist and liable to putrefaction, or hot and dry and liable to inflammation, to-



gether with this regimen the patient must take some of the remedies which we are about to describe. To those who are of a hot, dry, inflammable temperament give those garden herbs which are cooling, moist, and extinguish heat, such as purslain, Jew's mallow, strawberry blite, and also gourds, serpent cucumbers, cucumbers, and water melons.

(4.) As to melons, especially sweet ones, they are entirely forbidden; and if the patient happen to take any, he should drink immediately after it the inspissated juices of some of the acid fruits. He may be allowed soft fish, and butter-milk.

(5.) With respect to those who are fat, fleshy, and of a white and red complexion, you may be content to let them eat such food as we first mentioned, consisting of any cooling and drying things. They should be restricted from labour, bathing, venery, walking, riding, exposure to the sun and dust, drinking of stagnant waters, and eating fruits or herbs that are blasted or mouldy. Let their bowels be kept open, when there is occasion for it, with the juice of Damask plums and sugar, and whey and sugar. And let them abstain from figs and grapes; from the former, because they generate pustules, and drive the superfluous parts of the surface of the skin; and from the latter, because they fill the blood with flatulent spirits, and render it liable to make a hissing noise, and to undergo fermentation. If the air be very malignant, putrid, and pestilential, their faces may be constantly bathed with sanders water and camphor, which (with GOD's permission,) will have a good effect.

(6.) As to sucking infants, if they are above five months old, and fat, fair, and ruddy, let them be cupped; and let the nurse be managed with regard to diet in the manner we have mentioned. And let those infants that are fed on bread have those things which we have mentioned in a proper quantity.

(7.) We will now mention those medicines which thicken and cool the blood, and check its putrefaction and ebullition.

(8.) These are checked by all acid things, such as vinegar, butter-milk water of extreme acidity, (that is, the thin, bitter water which floats upon butter-milk when it is exposed to the sun,) and the acid juice of citrons; and still more useful are those

things which have an astringency joined to their acidity, such as the juice of unripe grapes, sumach, warted-leaved rhubarb, applies, quinces, and acid pomegranates; and those things which by their nature thicken the blood, such as jujubes, lentiles, cabbage, coriander, lettuce, poppy, endive, black night-shade, tabasheer, the seeds of fleawort, and common camphor.

(9.) The following is the description of a medicine which restrains the ebullition of the blood, and is useful against heat and inflammation of the liver, and effervescence of the yellow bile:—

(Form 1.) Take of Red Roses ground fine, ten drachms,  
Tabasheer, twenty drachms,  
Sumach,  
Broad-leaved Dock Seed,  
Lentiles peeled,  
Barberries,  
Purslain Seed,  
White Lettuce Seed, of each five drachms,  
White Sanders, two drachms and a half,  
Common Camphor, one drachm;

Let the patient take three drachms of this powder every morning in an ounce of the inspissated acid juice of citrons, or the inspissated juice of warted-leaved rhubarb, or the inspissated juice of pomegranates, or the juice of unripe grapes, and the like.

(10.) Oxymel, prepared with sugar in the following manner, is also useful:—

(Form. 2.) Take of best red Vinegar, depurated, one part,  
Rose Water, two parts;

Mix them both together, and macerate in them for three days—

Of Red Rose leaves dried, one ounce,  
Pomegranate flowers, half an ounce,  
Pomegranate peel, two ounces;

Then strain the liquor; afterwards boil it, and add to it, according to the original quantity of vinegar, twice or thrice as much white sugar candy; boil it sufficiently, and use it.

(11.) The following preparation will also be useful:--

(Form. 3.) Take of Roses,

Tabasheer, of each ten drachms,

White Sanders, three drachms,

Common Camphor, one drachm;

Knead them all together with the mucilage of Flea-wort seed, and make the mass into pills, or troches: of these at proper times three drachms may be given to drink in one ounce of the aforesaid oxymel.

(12.) Besides these the syrup of which the following is the description will be still more useful, and its virtue exceeds that of all the syrups which we have seen and tried; unless it be the syrup of pearls, which the Indians prepare in a different manner known only to themselves; for the Indians say, that if any one drinks of the syrup of pearls, even though nine pustules have already come out on him, there will not appear a tenth. The mode of preparing it is as follows:--

(Form. 4.) Take of the best old Vinegar depurated, three pints,

Acid Pomegranate juice,

Acid Juice of Citrons,

Juice of unripe Grapes,

Juice of warted-leaved Rhubarb,

Expressed juice of Syrian white Mulberries,

Infusion of Sumach,

and Berberries, of each one pint,

Expressed juice of Lettuce,

Expressed juice of Tarragon, of each one quarter of a pint,

Decoction of Jujubes,

Infusion of Lentiles, of each one pint and a half;

Mix them all together, add to them three pounds of sugar, and boil the whole; then take half a pound of tabasheer, and of common camphor, and put them into a clean mortar after they have been well pounded; pour upon them a little of this syrup, hot, and work them quickly with a pestle, until they are dissolved; then mix them with the whole; and con-

tinue stirring it from beginning to end, with a stick of open cane, or willow wood, (but cane is preferable,) after having thrown in tabasheer and common camphor, until they are perfectly united.

This may be used both before the symptoms of the Small-Pox appear, and also after their appearance, as we shall mention presently. It is likewise proper in all diseases connected with the blood and the yellow bile, in pestilential ulcers, boils, quinsies, and the like:—for it is useful, with GOD'S permission.

(13.) This may in general suffice concerning preservation from the Small-Pox before the coming on of the fever which is attended by the symptoms of it. And by this means the Small-Pox is entirely repelled from one who is in such a condition that it can be repelled: and whatever pustules do come out must needs be favorable and few in number. By this means also it is brought about that the change in the blood from the first state into the second should not be effected all at once and in a short time, with ebullition and fermentation, which are accompanied by frightful and dangerous accidents, but by little and little, and in a long time, and gradually, by way of ripening, not putrefaction, and without fevers that are either frightful, malignant, and dangerous, or else hurtful and without doubt painful.

(14.) But when the fever arises which is accompanied by the symptoms of the Small-Pox, this regimen is not to be used, except after much observation, inquiry and caution. For a mistake here is very dangerous; and for this reason, because the blood, when it ferments, is inflated and increased, and Nature, according to the temperament of the patient, is endeavouring to expel all its superfluous parts to the surface or to the members of the body; if, then, the cooling and thickening which you intend does not bring back the blood to a cooler and thicker state than it was in before its ebullition, the ebullition will break out a second or third time; and thus it will happen that you will be acting against Nature, and disturbing her in her work. Nor is it possible for the ebullition, if it be vehement, to be checked but by remedies in which there is great danger, and which do in a manner greatly congeal and coagulate the blood, (such as opium,

hemlock, a great quantity of the expressed juice of lettuce, black night-shade, and the like,) and by the constant and excessive use of the regimen which we have just mentioned. And the congelation of the blood and the extinction of the natural heat at the same time, from the excessive use of these remedies, is not safe. Besides, even if you do employ them to excess, you will not be able to extinguish the ebullition and to restrain the violence of the unnatural heat; for by this excess you at the same time depress the power which the natural heat has of resisting what is hostile to itself; and you extinguish this and the unnatural heat together. And this I here mention to you (a matter which some physicians pass over from ignorance, and some from avarice, that they alone may receive profit from it,) in order that you may not offend against Nature, as do they: by permission of the Almighty and glorious GOD.

(15.) When you perceive symptoms of the Small-Pox, and you see a distension of the body, frequent stretching, pain in the back, redness of the complexion and of the eyes, a very violent headache, a strong and full pulse, a shortness of breath, a red and turbid urine, and the body hot to the touch, like that of a man who has been in a bath; and when also the body is fleshy, and the patient's diet has been such as produces plenty of blood: then take from him a large quantity of blood, even until fainting comes on. It is best to take it from the basilic vein, or from some of its branches; if this cannot be found, then from the inner vein; and if this cannot be found, then from the cephalic. But when the basilic and its branches cannot be found, it is better to take the blood from the popliteal vein, or the saphena; because these draw the blood from the greater veins in the abdomen more than the cephalic does. When these symptoms do not run very high, although they are distinctly manifest, then take away less blood; and when they have but slight force, then draw but little blood; and afterwards proceed in the cure with extingvents, as I have already mentioned. When you find that by the use of extingvents the feverish heat is moderated, and the pulse and breathing are returned to their natural state, you should still continue to employ these remedies,—for by their means you will entirely drive away the ebullition of the Small-Pox.

(16.) In order more effectually to perform this extinction, let the patient drink water made cold in snow to the highest degree, several times and at short intervals, so that he may be oppressed by it, and feel the coldness of it in his bowels. If, after this, he should continue to be feverish, and the heat should return, then let him drink it a second time, to the quantity of two or three pints or more, and within the space of half an hour: and if the heat should still return, and the stomach be full of water, make him vomit it up, and then give him some more. If the water finds a passage, either by sweat or by the urine, then you may be sure that the patient is in a fair way of being restored to health; but if you do not see that the water has found a passage, or you find that the heat is increased, and returns as it was at first, or even is more violent, then omit giving the cold water in large quantities at several times, and have recourse to the other extingquents which I have described. And if you see them relieve the patient in the way I have mentioned, then persist in the use of them; if, however, you see that there arises any anxiety and inquietude after taking them, or that the anxiety and inquietude is altogether vehement and immoderate, then you may be sure that it is impossible to prevent the eruption of the Small-Pox or Measles. You must, therefore, then quit this mode of treatment, and hasten to assist Nature in expelling and throwing out these superfluities, in the manner I shall describe in the following Chapter.

## CHAPTER VI

### OF THOSE THINGS WHICH ACCELERATE THE ERUPTION OF THE SMALL-POX

The eruption of the Small-Pox and Measles is accelerated by well wrapping the patient up in clothes, and rubbing his body, by keeping him in a room not very cold, and by sipping cold water, a little at a time, especially when the burning heat is very great; for cold water, when it is sipped a little at a time, provokes sweat, and assists the protrusion of the superfluous humours to the surface of the body. Let the patient put on a double shirt, with the upper border closely buttoned; and underneath let there be placed two small basins of boiling water, one before and the other behind

him, so that the vapour may come to the whole body except the face; and the skin may be rarefied, and disposed to receive and evaporate the superfluous humours. For when the surface of the body is in this state, the patient is suffused with sweat, which is calculated to cool him and is very beneficial. And by this management not only is the surface of the body rendered soft, but also the strength of the patient is preserved, so that in this state nothing is more beneficial. And this may be effected by well wrapping the patient up in clothes, rubbing his body, and exposing it to the steam of hot water in the manner we have mentioned: for both the laver and the bath are injurious in this state, inasmuch as they overheat the superfluous humours, and depress the strength so much that a fainting fit comes on. And when this is the case, Nature is diverted from her work, and the patient is in danger, especially if the fit be violent and frequent; for nothing is a greater indication of the approach of death, especially in this case, than violent and frequent fainting; for it shows that Nature is (in a manner) routed, and retires, and contracts her power into the inner parts of the body; and when this takes place, it will immediately be oppressed and extinguished by the superfluous humours. Likewise after the hot vapour has been used, it must not be suffered to cool upon the body, but is to be wiped off with cloths, and dried with great care and diligence.

(2.) This method is sufficient to facilitate the expulsion of the superfluous humours to the exterior, when Nature is not languid, nor the superfluous humours too thick and viscid, and difficult to be expelled. When, however, the outward fever is mild and slight, but anxiety and inquietude continue, and the expulsion of the Small-Pox is slow and difficult, and delayed beyond the fifth day, you will then have to use those medicines which promote the eruption. But this is to be done with great caution and attention, in the way that I have already mentioned, when speaking of the conditions to be observed in giving extingents; for the error here, even if it be not equally important with the other, is important nevertheless. And the way to be preserved from falling into error in this case is to be not too hasty in using these medicines, but to be content with the former regimen as long as there is any hope of your being able to do without them, and as

long as you are pretty certain that the fever is as slight in the inward parts of the body as it is in the outward. This you will easily know, if neither the pulse nor the respiration be too quick, full, or irregular, and if on feeling the chest it be not found hot in the highest degree; and hence you may be sure that even if the force of the fever be doubly or trebly increased, it will not prove fatal to the patient, on account of the vehemence of its heat; of which you may judge by comparing this with other fevers which you have seen in the same patient or in persons of a similar temperament and in a like degree of heat, who have entirely recovered.

(3.) These extinguishing remedies are also to be used when you see, that, as soon as any of the pustules come out and appear in the skin, the patient finds himself easier after it, and his pulse and breathing are relieved in proportion; but if you see that the eruption and appearance of the pustules goes on slowly and with difficulty, you must in this case avoid all very extinguishing medicines, for to use them would be acting contrary to Nature, and hindering her from throwing out the superfluous humours upon the skin. And when there follows, upon the use of extingvents, any anxiety and inquietude which were not present before, and especially if there be a palpitation of the heart, then you may be sure that you have committed an error. You must, therefore, immediately take all possible pains to soften the skin, in the way I have mentioned; and give to drink from time to time warm water, either alone, or that in which there have been first boiled the seeds of sweet fennel and smallage, and others of the same kind to be hereafter mentioned, which facilitate the eruption of the Small-Pox according as you see the heat to be less or more inflamed, and as the patient is able to bear it; regard being also had to the sluggishness of the Small-Pox, and the slowness of the pustules in coming out.

(4.) The following is an easy, gentle mode of treatment, which will not excite too much heat, and will facilitate the eruption of the pustules:—

(Form. 5.) Take yellow Figs, to the number of thirty, of  
Raisins stoned, twenty drachms;

Pour upon them three pints of water, and let them boil gently



until they are nearly dissolved: give the patient to drink half a pint of this decoction, at three several times; then cover him up with clothes, and expose him to hot vapour, in the manner we have before mentioned.

(5.) The following preparation is more efficacious:—

(Form. 6.) Take of the aforesaid Decoction, four ounces,  
Of the Decoction of Sweet Fennel Seed and  
Smallage, two ounces;

Give it to the patient to drink, in the way we have mentioned.

(6.) The following is still more efficacious:—

(Form. 7.) Take of Sweet Fennel Seed,  
Smallage Seed, of each ten drachms;

Boil them in the aforesaid decoction until the water is red, then strain it, and give the patient to drink three ounces of it.

(7.) The following composition is very beneficial and useful at several times:—

(Form. 8.) Take of Red Roses, four drachms,  
Peeled Lentiles, nine drachms,  
Yellow Figs, to the number of ten,  
Of Gum Tragacanth, three drachms,  
White Raisins, stoned, ten drachms,  
Lac, cleared from its stalks and washed, three  
drachms,  
Sweet Fennel Seed,  
Smallage Seed, of each five drachms;

Boil all these in two pints of water until it is reduced to one pint and a half; and give the patient half a pint of it, with half a scruple of saffron, two or three times, as may be necessary.

(8.) We shall now speak of those parts of the body of which it is necessary to take care.

## CHAPTER VII

OF THE CARE TO BE TAKEN OF THE THROAT, EYES, AND THOSE PARTS OF WHICH IT IS NECESSARY TO TAKE CARE UPON THE APPEARANCE OF THE SYMPTOMS OF THE SMALL-POX

As soon as the symptoms of the Small-Pox appear, we must take especial care of the eyes, then of the throat, and afterwards

of the nose, ears, and joints, in the way I am about to describe. And besides these parts sometimes it will be necessary for us to extend our care to the soles of the feet, and the palms of the hands; for occasionally violent pains arise in these parts from the eruption of the Small-Pox in them being difficult on account of the hardness of the skin.

(2.) As soon as the symptoms of the Small-Pox appear, drop rose-water into the eyes from time to time; and wash the face with cold water several times in the day, and sprinkle the eyes with the same. For if the disease be favorable, and the pustules few in number, you will by this mode of treatment prevent their breaking out in the eyes. But when you see that the ebullition is vehement, and the pustules numerous in the beginning of the eruption, with itching of the eye-lids and redness of the white of the eyes, some places of which are redder than others; in this case pustules will certainly break out there unless very strong measures be adopted; and therefore you should immediately drop into the eyes several times in the day rose-water, in which sumach has been macerated. It will be still more efficacious to make a collyrium of galls in rose-water, and drop some of it into the eyes; or to drop into them some of the juice of the pulp of the acid pomegranate, first chewed, or squeezed in a cloth. Then wash the eye-lids with a collyrium composed of red horn poppy, the juice of unripe grapes, rusot, aloe, and acacia, of each one part, and a tenth part of saffron; and if you also drop some of this collyrium into the eyes, it will be useful at this time.

(3.) But if you see that the matter of the disease is violent, and the eruption very copious, so that you conclude that pustules will certainly break out in the eyes, because you see excessive redness in some parts of the tunica sclerotica, with a protuberance of the eye itself, and you find that when you have dropped into it some of the remedies I have prescribed, it does not altogether remove that redness, but only lessens it for a time, after which it returns more violently than before, or at least continues in the same state as it was before you began this treatment; you must not in this case proceed any longer in this method, but, instead of these things and the like, drop into the eyes a little

Nabathæan caviare in which there is no vinegar, nor any other acid.

(4.) (The pustules which break out in the tunica sclerotica do not injure the vision;) but those which come out in the cornea obstruct the sight, and are to be cured, according to the degree of their thickness or thinness, by means of such strongly dissolving medicines as we are about to mention; which indeed are sometimes successful, and sometimes not, according as the matter is more or less thick, or the body more or less hard or aged. But if one large pustule breaks out in the tunica uvea, then rub cuhl in rose-water, and drop it into the eye several times during the day, and put over it a compress and bandage; or else drop into it some of the collyrium above mentioned, after taking out the saffron and adding one part of hæmatite, that there may not happen any great prominence. And these things are what ought to be known concerning the eyes in this place.

(5.) Care is next to be taken of the throat and mouth, in order that no pustules may break out in them which may distress the patient, or hinder his breathing: for it often happens that in the bad kinds of Small-Pox obstinate and violent suffocations come on; and when this is the case, there is no hope of the patient's recovery. For which reason, as soon as the symptoms of the Small-Pox begin to appear, the patient should gargle his mouth with acid pomegranate juice, or an infusion of sumach, or the inspissated juice of white mulberries, or with some of those things which we have mentioned in the chapter on extingvents; or, if nothing else is ready at hand, with pure cold water, and that very often, in order that there may either be no eruption at all in the throat and mouth, or that what there is may be but slight. And, therefore, you should strengthen these parts, in order that they may not be attacked by numerous pustules, giving rise to suffocation; and be quick and diligent in applying this cure, when, besides the symptoms of the Small-Pox, there is a hoarseness of voice, straitness in breathing and about the fauces, and pain in the throat. And if you see these symptoms to be very violent, then take away blood from the cephalic vein, and that even after the whole eruption is over. And if the patient finds

anything in his mouth or throat which hurts him, and there is not much heat there, neither are his bowels too loose, then let him lick by degrees butter mixed with white sugar-candy; but if there be any heat and inflammation there, then give him a linctus of the mucilage of fleawort seed, peeled almonds, and white sugar-candy thus prepared:—

(Form. 9.) Take of Sweet Almonds peeled, one part,  
Gourd Seed, two parts,  
White Sugar Candy, three parts,  
Mucilage of Fleawort Seed, a sufficient quantity;

Make it into a linctus.

If the bowels be relaxed let the linctus be made of gum Arabic, peeled almonds, the seed of serpent cucumber, and wheat-starch, mixed up with mucilage of quince seeds.

(6.) In the next place we must take care of the joints, for there often comes out upon these a number of very bad pustules, which corrupt them to such a degree that the bones, ligaments, and tendons lie bare. Hasten, therefore, as soon as you see any symptoms of the Small-Pox, and especially if they are violent and excessive, and the pustules filled with fluid, hasten to attend to the joints, and bathe them with sanders, red horn poppy, Armenian bole, roses, common camphor, vinegar, and rose-water; but in the bathing do not go much beyond the joints. If the pustules that come out are very large, then open them at once, and let out the matter; and do not put off this operation, for delay is very dangerous.

(7.) After this you should take care of the nose and the ear, that there may not be in them a great quantity of pustules; for this is hurtful to the patient; and an eruption in the internal part of the ear is clearly dangerous. Apply, therefore, to the nose daily warm oil of roses with common camphor dissolved in it: and drop into the inner ear warm red vinegar, mixed with a collyrium of red horn poppy, or rusot, and then put in a piece of cotton; and let this be done two or three times a day.

(8.) Lastly, if a severe pain arises in the soles of the feet, then take care to anoint them with tepid oil, and foment them with hot water and cotton. If this does not abate the pain, nor

facilitate the eruption of the pustules, then beat up peeled sesamum with milk; anoint with it, bind it on with a cloth, and so leave it upon the part all night; then bathe the foot in warm water, and repeat the same again. Or bruise dates with butter, and apply them; or anoint with the lees of oil of ben: for these and the like things soften and relax the skin, and thus facilitate the eruption of the pustules, and lessen the pain.

## CHAPTER VIII

### OF THOSE THINGS WHICH RIPEN THE PUSTULES

When, after their eruption is completed, you observe that the pustules tend too slowly to maturation, and that the state of the patient has been benefited by the eruption, and that his breathing and pulse are also favorable, and that he is free from inquietude and anxiety; then it will be necessary to assist the maturation of the pustules. But if, together with a backwardness of ripening after their eruption, you perceive the pustules to be hard and warty, and the state of the patient to be not at all improved, or if his illness is increased, then you may be sure that the Small-Pox is mortal: in which case you need not aim at effecting their maturation, for they are of that kind which cannot be ripened.

(2.) The maturation of the Small-Pox, when it is curable, is to be effected by fomenting the body with the steam of hot water, or of a decoction of chamomile, violets, melilot, marshmallows, and bran of wheat, either separate or mixed together in two basins, as we have mentioned above, when we were treating of the mode of facilitating the eruption of the Small-Pox. And if the patient finds relief at this time from the fomentation, you may abstain from those fumigations which are commonly employed for drying up the pustules, until they are ripe, and capable of bearing those things which are necessary for drying them up; of which we are now going to speak.

## CHAPTER IX

### OF THOSE THINGS WHICH DRY THE PUSTULES

All those pustules that are very large should be pricked; and the fluid that drops from them be soaked up with a soft clean

rag in which there is nothing that may hurt or excoriate the patient. And at the same time let fumigations be made with dried rose leaves, or myrtle leaves, or sanders, or the leaves of the lily, or the tamarisk; roses being more suitable in summer, and the tamarisk in winter.

(2.) The Small-Pox sometimes abounds with too much moisture. When this is the case, order the patient to sleep upon a mattress of thin texture stuffed with pounded roses, or rice meal, or millet meal. If the patient's body be excoriated, put under him the fresh leaves of the lily, and besprinkle him with an aromatic powder, roses, and myrtle; and if any part be ulcerated, then sprinkle it with the red aromatic powder composed of aloe, frankincense, sarcocol, and dragon's blood. When the pustules break, either spontaneously or from the abundance of fluid contained in them, and are slow in drying up, then treat them with salt in this manner: take one ounce of oil of sesamum, and mix with it two drachms of Andarene salt, pounded like cuhl, and the same quantity of alum. With this liniment anoint the body, avoiding those parts which are excoriated and ulcerated,—for it must not be applied to those places, as it would pain them extremely. Let it remain on the patient for the space of an hour, and then let him wash himself with a decoction of emblic myrob-alans, the galls found on the white tamarisk, myrtle leaves, and pomegranate peels. If the desiccation be effected by these means, it is well; but if not, take of white Susian bole, or any sort of white bole, (only do not take any red bole,) and mix with it about a tenth part of Andarene salt, and a tenth part of alum. Make this into a liniment, and apply it; let it remain on for an hour or two, and then wash it off.

(3.) Next will follow the mode of taking away the eschars and dry scabs.

## CHAPTER X

### OF THOSE THINGS WHICH TAKE AWAY THE DRY SCABS AND ESCHARS

When desiccation of the pustules is effected, and scabs and dry eschars still remain upon the body, examine them well, and upon those that are thin and perfectly dried up, and under

which there is no moisture, drop warm oil of cassiaum every now and then, until they are softened and fall off; except, however, those which are on the face, for these are to be dressed with oil of pistachio. As for the larger sort which resemble eschars, if you see any moisture remaining in them, cut them off gently and remove them, without any application of oil. And if the places from which the eschars have been removed contain but little moisture, you may soak it up with soft cotton rag, as I have already said; but if they contain much, then besprinkle them with a little of the red aromatic powder, especially if they begin to lessen and sink in; and with alum and salt, if they are even with the surface of the body, and do not sink in: then wait until a new eschar is formed on them. If there be still any moisture, then repeat the same treatment; and if there be no moisture, then anoint the scabs with oil, that they may be softened and fall off.

(2.) Next will follow a discourse on the mode of destroying the marks of the Small-Pox.

## CHAPTER XI

### OF THOSE THINGS WHICH REMOVE THE MARKS OF THE SMALL-POX

The marks of the Small-Pox are of two sorts; viz. either in the eye, or on the rest of the body.

I. (2.) In the eye the part on which the Small-Pox broke out is covered with an opaque whiteness, as we have already mentioned. When this happens in the eyes of children, of those, namely, who are of a moist constitution of body, and tender skin, it is the more easily deterged.

(3.) Now, the medicines which deterge the eye and take off the whiteness, are, sal prunella (?), Andarene salt, sal ammoniac, bastard sponge, glass-gall (?), the sea-crab, the dungs of sparrows, swallows, starlings, mice, and crocodiles, the common sweet flag, ebony, greater celandine, coral, tutty, haematite, verdigris, Arabian sugar, the dregs of vinegar burnt, the sediment of urine, myrrh, juniper resin, olive gum, bitter almond gum, the milky juice of wild lettuce, glass, the dung of bats, and musk. It will be best to use these when the patient is just come out of the

bath, or after holding his head over the steam of hot water; and it is right to make use of mild medicines alone, nay, the mildest of these, especially in soft and moist bodies.

(4.) The description of a mild medicine which removes the white specks from the eye:—

(Form. 10.) Take of Sarcocol,  
White Sugar Candy;

Sprinkle the powder in the eye.

(5.) Another more efficacious:—

(Form. 11.) Take of Bastard Sponge,  
Sarcocol,  
Sugar;

Sprinkle the powder in the eye.

(6.) Another still more efficacious:—

(Form. 12.) Take of Sal Prunella (?),  
Bastard Sponge,  
Glass-gall (?),  
Sarcocol,  
Sugar;

Sprinkle the powder in the eye.

(7.) Another still more efficacious:—

(Form. 13.) Take of Virdigris, ten drachms,  
Gum Sagapenum,  
Gum Ammoniacum,  
Sarcocol, of each two drachms and a half,  
Bastard Sponge,  
Glass-gall (?),  
Sal Prunella (?), of each three drachms;

Then take of common Sweet Flag,

Greater Celandine, of each ten drachms;

Boil them in ten times their weight of water, until the decoction becomes thick; then dissolve the gums in it, and knead the rest together, and make the whole into an ophthalmic collyrium.

As occasion may arise, rub some of this paste with water in an ebony mortar, so that the mixture may be thick; then put some of it on a style, and apply it frequently to the part affected.



Both before and after the operation let the eye be several times licked with the tongue; and afterwards sprinkle it with the milder sort of aromatic powder. But be sure to look carefully and frequently into the eye; and if it be painful and red, then omit this treatment for some days, and afterwards repeat it; for it is a very efficacious mode of cure.

II. (8.) As to the medicines which remove the marks of the Small-Pox from the face and the rest of the body, they are these:—white litharge, dried reed roots, rotten bones, bastard sponge, coral, sarcocol, almonds, birthwort, the bennut, the seeds of radish, melon, and rocket, and the meal of beans, rice, lupines, and kidney beans: let the patient be anointed with these in rice water, or barley water.

(9.) The description of a liniment which removes the marks of the Small-Pox:—

(Form. 14.) Take of

the Meal of common Chick Peas,  
Bean Meal, of each three drachms,  
Melon Seed, five drachms,  
White Litharge, two drachms,  
Reed Roots dried, three drachms;

Pound all of them together in barley-water; then anoint the patient several times successively after he has held his head over the steam of hot water, or after coming out of the bath. Then wash him in a bath made of a decoction of melon rinds, dried violets, bran, and common chick peas pounded; rub him well, and then apply the liniment a second time.

(10.) The description of another liniment more efficacious than the former:—

(Form. 15.) Take of

the meal of Beans resembling lupines,  
five drachms,  
Bitter Almonds,  
Sweet Costus,  
Rocket Seed,  
Radish Seed, of each two drachms and a  
half;

Use the liniment as we have directed.

(11.) Another liniment still more efficacious:—

(Form. 16.) Take of

Bitter Almonds, peeled, five drachms,  
Radish Seed,  
Rocket Seed,  
Costus,  
Long Birthwort, of each two drachms and  
a half,  
Sal Prunella (?), three drachms,  
Pepper, one drachm and a half;

Use them as we have directed; and anoint the parts with radish water, or with what we have before prescribed.

(12.) These, therefore, are the medicines which remove the marks and scars of the Small-Pox: and in order to efface the pock-holes, and render them even with the surface of the body, let the patient endeavour to grow fat and fleshy, and use the bath frequently, and have his body well rubbed.

(13.) We will now speak of what ought to be given to a patient in the Small-Pox by way of food, and of the medicines to be used in the treatment of him.

## CHAPTER XII

### OF THE PATIENT'S FOOD IN THE SMALL-POX

To a patient in the Small-Pox it is necessary to give to drink barley water prepared in the same manner and with the same art as that which is usually given to persons in acute diseases. If the fever be moderate and mild, and the bowels somewhat costive, it must be sweetened with white sugar-candy; but if the heat of the fever be intense, and the bowels relaxed, then pour to it half its quantity of acid pomegranate juice, pounded with the seeds, but avoiding the pulp and inward thin tunicles, for these are aperient. If the patient be also restless and cannot sleep, add to the peeled barley used in preparing the barley water about half the quantity of poppy. But if the bowels be very loose, then take equal parts of peeled barley, of dry seeds of acid pomegranate, and poppy. But if it be necessary to bind

the bowels, then instead of peeled barley take parched barley meal previously prepared with the meal of parched pomegranate seeds; boil these in the same manner as barley water is made, and let the patient drink of this, as he would of barley water, either alone, or mixed with tabasheer and gum Arabic, if a looseness of the bowels should make it necessary, or with the medicines which we shall describe anon. And barley water, mixed with acid pomegranate juice is very useful in the Small-Pox, and more especially in Measles. And also the juice of the gourd, of the Indian melon, and of the serpent cucumber, and the mucilage of fleawort seed, and the like, which make a mild phlegm and easy to be spit up; these, I say, are more useful in the Measles than in the Small-Pox, unless it be in those sorts of Small-Pox which are accompanied with extreme malignity, intense heat from the fever, and want of sleep.

(2.) But in those cases of the Small-Pox which are accompanied with fever wherein there is not so violent an inflammation, the things above mentioned and others of the like kind render them much slower, and protract the length of the disease; so that you must use them, or not, as occasion shall require. For since the Small-Pox arises in most cases from heat and putrefaction acting upon moisture, those things are more suitable, which have a drying and thickening power together with a cooling power, such as water of pomegranates, juice of unripe grapes, and the like; but since the Measles arise from a vehement ebullition of the bile in the blood, those things are most salutary, which, together with a cooling power, have a moistening power also, in order that the corrupted blood may be tempered and corrected by their means. For the blood of a person in the Measles, is like stagnant water, which has been long putrid, and which, having lost its sweetness by the action of the sun, has contracted a vicious acrimony; but which, when it is mixed with rain water or running sweet water, recovers its former wholesomeness.

(3.) Moreover, in the Small-Pox the meal of parched barley is useful when it is washed and taken with sugar or in pomegranate water, or in julep, according as may be required by the loose or costive state of the patient's bowels, as likewise the

greater or less ebullition of heat: except that barley water is lighter for him to take in the Small-Pox, easier to swallow, and more beneficial to his throat and chest. So that you must act according to circumstances, after you have been apprised that barley water is more suitable for persons in the Measles than in the Small-Pox, unless it be of a bad sort, in the manner we have mentioned.

(4.) Peeled lentiles are likewise useful in the Small-Pox, when a food is prepared of them with the water of acid pomegranates, or with vinegar: as is also the parched meal of lentiles, when it is taken in cold water. You should know also that the drinking cold water is more serviceable to a patient in the Measles than in the Small-Pox, as being safer and of a more certain effect. However, when you see the Small-Pox attended with violent inflammation, and the quickness or intermission of the pulse and respiration, then make use of extinguishing medicines in proportion to the symptoms; if they are less urgent, employ few, and if very urgent, then give many. But do not allow the patient to eat young birds until the pulse and respiration have returned to their natural state; nor till the pustules are dried up, and the scabs fallen off.

(5.) Next will follow the discourse on relaxing the bowels and confining them in the Small-Pox.

### CHAPTER XIII

#### OF THE REGULATING THE PATIENT'S BOWELS IN THE SMALL-POX

The bowels are generally relaxed in the Small-Pox and Measles towards their decline, and especially in the Measles; for which reason, after these diseases have passed their crisis, everything must be avoided which opens the bowels, even if they should be confined. But if the bowels are relaxed, then you should from the first abstain from opening medicines, although it be necessary to employ them in the beginning of these two diseases, and before the crisis is passed. For it is sometimes necessary to open the bowels in the Small-Pox, either because of the excess of heat and headache, or in order to ease Nature of her load, and to lessen the morbid matter, when you have reason to think it over-

abundant. And this will be the case when you find the body, both before and after the bloodletting, neither weakened nor wasted, but on the contrary bloated and full, with a paleness of colour, or but little of redness, and a fluctuation in the pulse. For sometimes in such a state it is not necessary to take away blood, but to evacuate from the body the superabundant moisture; and that especially when the aforementioned symptoms are very plain and evident, and the body is troubled with boils from the sluggishness of the fever, and is destitute of a red colour. In this state one of the best things is a decoction of yellow or chebule myrobalans alone, when it is drunk with white sugar-candy, and the water of an acid pomegranate bruised with its pulp, to which may be added one or two more pomegranates if there be occasion. For it is the property of these two medicines (especially pomegranate water), to diminish the superabundant moisture of the body, together with part of the bile, without exciting any heat, and to leave nothing behind them in the bowels. And these are some of the best things that can happen in this stage of the disease.

(2.) But in the Measles, give the water of damask plums, or the plums themselves, fresh gathered, and macerated in julep, with sugar added. But avoid the medicine called taranjubin, which is as prejudicial in the Measles as honey is in the Small-Pox, both on account of the surfeit which it occasions, and also because it increases the nausea and anxiety of the patient. In like manner you should carefully avoid giving them to drink milk and violets, for both of these will also increase the nausea and anxiety in those who already feel any.

(3.) Now whereas the first and most necessary remedy in the Small-Pox is to draw blood when it is too much in quantity, and there is no hope of checking its ebullition by extingquents; (but it is necessary to take some away, as well for relieving Nature, as for abating the fullness of the blood-vessels, and their swelling and distension from the too great quantity of their contents, which must otherwise be productive of very bad consequences, especially when the blood is heated to that degree that the exhalation is too great;) in like manner in the beginning of the

Measles it is right to draw off some of the bile, when you see it to be over-abundant, and then to pursue what remains of it by extingvents. Now the sign of an excessive redundancy of the bile is the violence of the inflammation, and anxiety, together with the discharge of the same bile both by vomit and stool, and a bitter taste in the mouth. But if the quantity of the bile be not excessive, and yet there is anxiety and thirst and vehement heat, without any discharge of bile either by vomit or stool, though its quantity, I say, be not excessive, we may judge it to be of a bad quality in proportion to the violence of the inflammation and anxiety.

(4.) And this is what you ought to know concerning the regulating the discharges of the bowels in the beginning of these two diseases. Now when the bowels are relaxed, give nothing laxative; for in either of these diseases the patient will be in danger from the excessive looseness of the bowels, if he drinks anything which increases their discharge. When, therefore, the bowels are relaxed, give the patient barley gruel to drink, instead of barley water; and, if it be necessary, boil with the barley gruel the parched meal of pomegranate seeds; and if, notwithstanding, the looseness still continues, then mix in his drink gum Arabic and tabasheer, in this manner:—

(Form. 17.) Take of Gum Arabic, two drachms,  
Tabasheer, one drachm;

Pound them as small as cuhl, and sprinkle the powder into four ounces of barley gruel, and give it to the patient to drink, if his bowels be much relaxed.

And give him also to drink, about an hour before the barley gruel, some of this medicine which I am going to describe; and then give him barley gruel.

The following is the description of it:—

(Form. 18.) Take of Red Roses ground fine,  
Tabasheer,  
Broad-leaved Dock Seed,  
Sumach,  
Barberries, of each equal parts,  
Gum Arabic,

Lemnian Earth,  
 Poppy Rinds,  
 Pomegranate Flowers, of each half  
 the quantity;

Give the patient to drink three drachms of these in one ounce of the inspissated juice of green and acid quinces.

(5.) But if the looseness still continues, and the patient is weakened by it, let him drink sour butter-milk, from which the butter has been carefully removed, with the best sort of biscuits, and a little gum Arabic. Lastly, there often comes on a dysentery, and when this is the case the mode of treatment must be taken from the place where we have treated of that subject.

(6.) And now we will speak of the mild and fatal species of the Small-Pox and the Measles.

#### CHAPTER XIV

##### OF THE FATAL AND MILD SPECIES OF SMALL-POX AND MEASLES

The Small-Pox and Measles are of the number of acute and hot diseases, and therefore they have many things in common with them, with respect to the symptoms which indicate the disease to be mild or fatal. Now the chief prognostic signs in those who recover are, a freedom of respiration, soundness of mind, appetite for food, lightness of motion, a good state of the pulse, the patient's confident opinion respecting the event of his own illness, a convenient posture in bed, and but little tossing about and inquietude of body. Hence a judgment may be formed of the bad signs, some of which we have briefly but correctly mentioned in the book called 'Al-Mansuri.'

(2.) The circumstances which peculiarly regard the Small-Pox and Measles are the following. When the pustules of the Small-Pox are white, large, distinct, few in number, and easy in coming out, and the fever is without much violence and heat, or distress and anxiety; and when the patient's heat and distress and anxiety diminish upon the very first eruption, and entirely cease after the eruption is completed; that sort is the most curable and least dangerous. To these the next in goodness are those that are white and large, though they may be very numer-

ous and close together, if the eruption has been easy, and has relieved the patient from his anxiety and heat, as we have already mentioned.

(3.) But when the appearance of the pustules is brought about with difficulty, and the patient is not relieved upon their eruption, they are a bad sort; although there is not so much reason to be afraid if the patient's condition be unfavorable during their appearance, as if it continues so afterwards. But there is a bad and fatal sort of the white and large pustules, viz. those which become confluent and spread, so that many of them unite and occupy large spaces of the body, or become like broad circles, and in colour resemble fat.

(4.) As to those white pustules which are very small, close to each other, hard, warty, and containing no fluid, they are of a bad kind, and their badness is in proportion to the degree of difficulty in their ripening. And if the patient be not relieved upon their eruption, but his condition continues unfavorable after it is finished, it is a mortal sign.

(5.) And as to those which are of a greenish, or violet, or black colour, they are all of a bad and fatal kind; and when, besides, a swooning and palpitation of the heart come on, they are worse and still more fatal. And when the fever increases after the appearance of the pustules, it is a bad sign; but if it is lessened on their appearance, that is a good sign. Doubled pustules indicate an abundance of the matter of the disease, and if they are of the curable sort, they portend recovery; but if they are of the mortal kind, they portend death.

(6.) The safest kind of Measles is that where the redness is not very deep; but the pale or tawny coloured are bad; and the green and violet coloured are both mortal. When either the Small-Pox or Measles sink in suddenly after they have begun to come out, and then the patient is seized with anxiety, and a swooning comes on, it is a sign of speedy death, unless they break out afresh.

(7.) When the pustules appear on the first day that the patient is feverish, they will hasten their progress and be of quicker motion; if they appear on the third day, the eruption will advance



moderately; but if the first appearance is delayed beyond the fourth day, the eruption will be completed dully and slowly. When the eruption breaks out on the good critical days, it is a salutary sign, especially if the patient is relieved at the end of it; and so on the contrary.

(8.) When the pustules begin to be confluent and to spread, and the anxiety is very great, and the abdomen is inflated, then death is near at hand.

(9.) When the smaller sort of pustules, which contain no fluid, break, and at the same time a delirium comes on, then the patient is near his end.

(10.) When the Small-Pox and Measles first appear, and afterwards sink in again, and there comes on at the same time anxiety and delirium, this is a fatal sign, whatever their colour may be; but this is seldom the case with the white pustules, and those which ripen, and contain fluid quickly.

(11.) When towards the end of the Small-Pox there is great perturbation of the humours, and the patient is seized with a very violent pain in the leg, or hand, or any other limb, or the pustules turn to a green or black colour, and thereupon he becomes weaker than he was before, and the weakness still increases with the increase of the pain, or the limb is deeply coloured; these are signs of death.

(12.) But if, nevertheless, the patient's strength increases, he will recover, but the limb will mortify. And if you scarify that limb quite at the beginning of the pain, if the patient grows stronger after it, you will do him great service, and the limb will thereby be preserved from mortification. But in a case like this nothing cooling is to be applied to the limb, but it may either be scarified, or plunged into hot water, when you see that the state of the patient is able to bear it.

(13.) Now, therefore, as we have gone over all the articles which were proposed concerning the mode of treating this disease, and of preservation from it, we will here break off the thread of our discourse; and to HIM Who hath given us understanding to accomplish the work be praise and glory without end, even as HE is most worthy and deserving thereof.



## LIBER AD ALMANSOREM

### Lib. x. Cap. 18

#### ON THE SMALL-POX AND MEASLES

(1.) When anybody (especially a child or young person), is seized with an acute continued fever, together with a pain in the back, itching in the nose, starting in sleep, heaviness of the head, redness in the cheeks and eyes, and a pricking all over the body, then you may be sure that the patient will certainly have either the Measles or the Small-pox shortly break out.

(2.) If therefore you are summoned to the patient before the disease breaks out, you should by all means cause him to lose blood either by the lancet, or cupping-glasses; and give him to drink troches of camphor in acid pomegranate juice. For food let him merely take barley water each morning and evening; or if his strength be much reduced, and he himself wishes for more food, let him have some peeled lentils prepared with vinegar, and a linctus composed of sugar and oil of almonds, together with whatever cooling herbs you may have at hand. For drink let him have the inspissated juices of acid, styptic fruits; or if the bowels be constipated, give him an infusion every day. By this regimen the eruption will either be altogether prevented, or, if it has already appeared, it will be but slight.

(3.) But if the patient is not seen until the eruption has begun to come out, you must not then bleed him, nor give him troches of tabasheer, but wrap his body up in clothes in order to provoke and keep up a perspiration, for by this means the eruption will be facilitated. But if you find it to be slow in coming out, and the patient is troubled with much swooning, and anxiety, with occasional delirium and palpitation of the heart, then you may let him drink several times a day a decoction composed of a

handful of figs, raisins, dried lentils, sweet fennel seed, and twigs of lac.

(4.) You should also drop into the eye rose water in which sumach has been macerated, or the juice of the pulp of pomegranates. And let the patient drink cold water, mixed with a little vinegar; and let him wash his face, and gargle with it, to prevent the pustules breaking out in his nose, or eyes, or throat. But if any should come out in his eye, or ear, or throat, then let some cold be rubbed up in cedar leaf juice, and dropped into it several times a day.

(5.) When the pustules are all come out, and ripened, let the patient sleep upon willow leaves, or sprinkle powdered roses upon his bed. And when they are slow in drying up, and very large, with superabundant moisture, then bathe him with water of naphtha salt; and let a fire be lighted, and fumigations be made, in the winter with tamarick, and in the summer with sanders, rose leaves, and myrtle leaves; and if the desiccation is still delayed, boil these, and put the patient into the water.

(6.) When the desiccation of the pustules is effected, and foul scabs and dry eschars still remain upon the body, and are difficult to be removed, then anoint them with tepid oil on cotton several times a day, till they all fall off, and the patient recovers. And if it is necessary to remove the marks of the Small-Pox that remain, let them be frequently anointed with some of the medicines mentioned in the chapter on that subject, and then let the patient go into the bath.

(7.) He must also use a suitable diet. If the Small-Pox and Measles break out, and blood has not been drawn, then let him take the juice of pomegranates, and troches of tabasheer, and all things of a cooling nature. But do not allow him to eat young birds until the scabs of the pustules are fallen off, and the fever and the heat have left the body.

(8.) Be careful not to give him anything which opens the bowels, after the Small-Pox or Measles has fully made its appearance; and if they are relaxed, let him drink barley gruel, with tabasheer, and gum Arabic, Armenian bole, and roses, as we have mentioned in the chapter on Diarrhoea.

(9.) The worst kind of Small-Pox is that in which the pustules are of a violet colour, small, hard, and slow in ripening; and in like manner the Measles which are of a violet colour are of a bad sort. When you see the Small-Pox and the Measles are difficult in coming out and in ripening, and the patient's fever and anxiety are not quieted nor alleviated, and there comes on, besides, a fainting and palpitation of the heart, the patient will surely die; but if the pustules are quick in coming out and in ripening, and the fever and heat are quickly alleviated, he will recover.

## DIVISIO MORBORUM

### Cap. 149

#### ON THE SMALL-POX AND MEASLES

(1.) The premonitory symptoms of the Small-Pox are an acute continued fever, a violent pain in the back, itching in the nose, and starting in sleep; but if the fever be attended with more vehement heat, and greater anxiety, then the Measles may be expected.

(2.) The proper treatment of the Small-Pox, when the symptoms are beginning to appear, is bloodletting, but not afterwards; but observe, and if the patient is in good spirits about his illness, without any great anxiety, and the pustules have already begun to come out, then treat him with those things which hasten the eruption; and do not let him drink anything very cold, in order that the eruption of the pustules may not be stopped, and there may not come on any slowness and difficulty in bringing them out. But if you see the pustules are sluggish in coming out, then give him a decoction composed of figs, with twigs of lac, and a little saffron, in order to hasten their eruption.

(3.) When all the pustules are come out, you must next assist their maturation by proper regimen, and by steaming the body with the vapour of hot water, if they have not begun to ripen; and let the patient be treated with the diet of those who have boils, and let him have for drink barley water, and the like, according to the violence of the febrile heat. Be careful not to give him anything which opens the bowels, especially in the

Measles, and towards the end of the disease; for a diarrhoea at this time may end fatally. When you ripen the pustules by steaming them with the vapour of hot water, then assist their drying up by fumigations with myrtle leaves, and rose leaves, and with the tamarisk; and boil these, and wash the pustules with the decoction, if their desiccation is delayed.

(4.) While the desiccation is going on, if there are any pustules that are difficult to dry up, drop on them salt and water; and when their desiccation is completely effected, then drop on them tepid oil several times a day, until all the scabs fall off.

(5.) As soon as the symptoms of the Small-Pox appear, you should drop into the eyes rose water in which has been macerated sumach and rue seed. When there comes on a redness of the white of the eye, and itching of the eyelids, or a white spot in the cornea; or if that does not happen, and you see but few pustules, then you will have need of this; but if you find that the itching of the eye is not assuaged, but on the contrary becomes more violent than before, then drop into it caviare and salt; and steam it with the vapour of hot water.

(6.) The Measles are more to be dreaded than the Small-Pox, except in the eye. You must, therefore, administer those things which draw off the bile with ease, and without heating; such as the water of damask plums, of a pomegranate bruised with its pulp, with sugar, barley water, the water of the Indian melon, of the water melon, and of the gourd, and the mucilage of fleawort seed. But if you find the patient after this medicine suffers uneasiness and anxiety, and perhaps fainting, then let him sip cold water, and sit in it for a short time; and rub his body, and cover him up, until his inquietude is assuaged, and the Measles come out to the surface of the body; after which you may have recourse again to such remedies as extinguish the fever.

(7.) You should carefully watch the state of the bowels towards the end of the disease, that there may be nothing to bring on a fatal diarrhoea; and if you find in the patient a bloody exudation from the places of the eruption of the Measles, make him sit in a hip bath of cold water.

(8.) You should know that the Measles which are of a deep

red and violet colour are of a bad and fatal kind; and that the Small-Pox in which the pustules are yellow, hard, close together, confluent, numerous, and of a deep red or violet colour, and that kind which spreads like herpes, and gives the surface of the body the appearance of vibices, are all bad and mortal.

(9.) As soon as you see the symptoms of the Small-Pox, you should order the patient to gargle his mouth with rose water, in order that the eruption which comes out in his throat may be lessened; and drop into his ear a collyrium of red horn poppy with vinegar and water, in order that the eruption which comes out in his ear may be lessened; and make him snuff up into his nostrils oil of myrtle, in order that the eruption which comes out in his nose may be lessened; for when you have done this he is relieved from great suffering.

(10.) If he complains of a pungent pain in the soles of his feet, and the palms of his hands, let him put them frequently into hot water. Do not allow him to eat young birds in either of these diseases until the scabs of the pustules are fallen off, and the thirst and difficulty of breathing are gone. After the scabs are fallen off, the frequent use of the bath and a fattening regimen of the body will efface the pock-holes; and those medicines which eradicate tetters or blemishes in the skin, destroy the marks of the Small-Pox.

## LIBER CONTINENS

### Lib. XVIII. Cap. 8

(1.) Al-Yehúdí says:—"When the pustules of the Small-Pox are small, close to each other, and of a greenish colour, the disease is fatal; but when they are large and distinct, it is curable."

(2.) He also says:—"When the pustules of the Small-Pox break out, do not treat the disease with refrigerant medicines, by which you may hinder the throwing out the superfluous humours, but let the patient take the seeds of sweet fennel and smallage, and sugar, in order that they may be soon brought out from the interior. And on the fourth day give him barley water and the decoction of jujubes and sugar. And if his bowels be confined, you may open them at the beginning of the disease

with the water of taraqubin and the like, but not towards the end, for then you should render them as much constipated as possible."

(3.) He also says: "Let the patient gargle and rinse his mouth with sweet fennel water, and sugar, and a little saffron water, and let him suck pomegranates, in order that there may be no eruption in the mouth and throat. And make a collyrium with caviare, or with cuhl, in coriander juice, or camphor water, to prevent the pustules from coming out in the pupil."

(4.) You must also take care of the inside of the nose, that there may be no eruption in it; you should therefore apply red horn poppy, or ruot, sanders, and vinegar, and let the patient frequently smell vinegar and water during the day, by which means he will recover. If the bowels be relaxed towards the end of the disease, give the patient troches of broad-leaved dock, and let him eat woodcocks, with the seeds of pomegranates, and the juice of unripe grapes. If there is a pain in the throat, let the patient suck the inspissated juice of unripe grapes. After the seventh day sprinkle on him water with salt and a little saffron, and afterwards roses, sanders, lentils, and a little common camphor; and give him to eat those things which are light, drying and extinguent. And in the winter let a fire be lighted with tamarisk; and when the pustules are riped let the patient sleep upon a mattress stuffed with the meal of rice, millet, barley, or beans; by which means they will quickly dry up.

(5.) The pustules which come out after the fever are less dangerous than those which precede it.

(6.) The symptoms of the Measles are a hoarseness of the voice, redness of the cheeks, pain in the throat and chest, dryness of the tongue, pain and heaviness of the head, redness of the eyes, with a great flow of tears, nausea, and anxiety: when therefore you see these symptoms, the Measles are certainly about to appear. And the Measles come out all at once, but the Small-Pox gradually. The Measles that are green or violet coloured are of a bad kind, especially if they sink in suddenly, for then a swooning will come on, and the patient will soon die. In the Small-Pox, when the pustules are black, dry, containing no

fluid, hard, and warty, swooning comes on, and the disease is fatal. When the pustules are very moist, let fumigations be made with myrtle leaves; and afterwards, in order to remove the marks of them, wash the scars with powdered reed roots in water or litharge.

(7.) Oil of pistachio also entirely removes the marks of the Small-Pox.

(8.) At-Tabarí says:—"When there is redness of the eyes and face, with fever, heaviness of the body and head, itching in the nostrils, and there comes on sneezing, inquietude, and anxiety, all this indicates an attack of Small-Pox. You should drop into the eye cuhl rubbed up and dissolved in rain water, or in coriander juice, and squeeze into the eye the juice of pomegranate pulp, or vinegar with white naphtha.

(Form. 19.) Take of (washed Lac),

Peeled Lentiles, of each six drachms,  
Gum Tragacanth, three drachms;

Boil them in half pint of water, until only the half of that quantity remains; and give it the patient to drink.

This hastens the eruption of the pustules: and let the food be lentiles peeled and roasted, with pomegranate juice, and styptic fruits."

(9.) At-Tabarí says:—"When the Small-Pox and Measles appear, make a collyrium with caviare, which strengthens and preserves the pupil, and does away with any opacity."

(10.) Ahrún says:—"Pestilential ulcers are hot abscesses, which appear in the groin and armpit, and prove fatal in four or five days. Those which are black are malignant; the red are sometimes fatal; but when they are black or green the patient hardly ever recovers. And so also with the Measles and the Small-Pox, and other eruptive diseases, those that are black or green are the most malignant; the yellow are also dangerous, but not so much so as those just mentioned; while those that are red or white are the most curable."

(11.) He says also:—"The Small-Pox, boils, and the like, all arise from blood that is corrupt and adust with yellow bile."

(12.) He says also:—"When the patient is able to bear it,



nothing is more beneficial than blood-letting in a case of pestilential ulcer. And let the part be afterwards anointed with Armenian bole, and let the patient take some of the same medicine in cold water, for it is beneficial."

(13.) The symptoms of the Small-Pox and of the Measles are an acute fever at the very beginning, with headache, and redness of the eyes. The eruption generally appears on the third day from the beginning of the fever, but sometimes on the first or second day. One of the most favorable symptoms is the appearance of the eruption on the third day, or at the time when the fever is mild; and vice versa. When, however, they appear on the first day, it is from the violence of the fever or intense mental application.

(14.) The fever attending the Small-Pox is a continued fever, and for the most part attacks children. When you see the eruption appear, do not give the patient medicines to extinguish the fever, but rather let him drink a decoction of the seeds of sweet fennel and smallage, in order to bring it out from the interior.

(15.) Before the eruption begins to appear you should bleed the patient; but not afterwards.

(16.) Let the patient keep in his mouth a decoction of lentiles and roses, and make a collyrium for his eyes of antimony and camphor, in order to prevent the pustules from coming out in his mouth, throat, and eyes.

(17.) When the pustules of the Small-Pox are of a violet or greenish colour, the disease is of a fatal kind. When the pustules are ripened, let the patient sleep upon rice meal, and let fumigations be made with myrtle leaves or olive leaves; for these things tend to dry the pustules. Modern physicians are accustomed to give to drink butter-milk from which the butter has been removed. The favorable and unfavorable symptoms of the Small-Pox and Measles may be learned from the chapter on the symptoms of acute diseases.

(18.) The author of the "Abbreviationes," or "Epitome," says:—"The Small-Pox and Measles belong to the species of hot diseases; they both occur for the most part when the southerly winds are violent, especially if this is in the summer; and in

those persons who have for a long time omitted blood-letting."

(19.) According to my own experience, the symptoms of the Measles and Small-Pox are, a continued fever, starting in sleep, redness, itching in the nose, violent pain in the back, constant yawning and stretching, and an inflamed colour.

(20.) As-Sáher says:—"Whenever with a continued fever there is a redness of the eyes and cheeks, itching of the nose, and heaviness of the head, then either the Small-Pox or the Measles will shortly appear. When the Small-Pox begins to make its appearance, you should endeavour to bring the eruption quickly to the surface, so as to prevent palpitation of the heart or sudden death; for which purpose you may give him the following mixture:—

(Form. 20.) Take of washed Lac, five drachms,  
Peeled Lentiles, seven drachms,  
Gum Tragacanth, three drachms;

Boil them in half a pint of water until the decoction is reduced to half the quantity; and give it the patient to drink.

And take care not to open the patient's bowels after the first week; but let his food be astringent, such as lentiles with pomegranate water and vinegar. And when all the pustules are come out, light a fire, if it be in the winter, with the wood of the tamarisk, oak, and vine; but in the summer the fire will not be necessary."

(21.) You should, however, fumigate his room with sanders, and spread the floor with the tops of myrtle and willow, and the leaves of the pomegranate tree. And when the desiccation of the pustules begins, sprinkle the patient with rice meal and millet meal, and a little saffron.

(22.) I think that what has just been mentioned is useful in removing the marks of the Small-Pox; and it should be frequently applied to the face. If the nose is affected, apply to it wax dissolved in oil; and if the mouth, use mucilages.

(23.) The following medicine is useful for bringing out the Small-Pox:—

(Form. 21.) Take of Figs to the number of five,  
Raisins, seven drachms,

Peeled Lentiles,  
 Lac, of each three drachms,  
 Gum Tragacanth,  
 Sweet Fennel Seed, of each two drachms;

Boil them in a pint and a half of water.

This medicine hastens the eruption of the Small-Pox, and prevents palpitation of the heart, and heat in the chest, and neighbouring parts.

(24.) Figs have the property of bringing out the Small-Pox from the interior.

(25.) From the "Liber Liberationalis," (or "the Successful?"): "A medicine which renders the eruption of the Small-Pox easy, and should be given at the commencement of the disease, as soon as the pustules begin to appear:—

(Form. 22.) Take of large White figs to the number of five,  
 Peeled Lentiles, seven drachms:

Boil them in a pint and a half of water until a quarter of a pint remains; then mix in it one quarter of a drachm of Saffron, and let the patient drink it fasting, and at bed time."

(26.) Ibn Músawwih says: "When you see the boils tawny coloured, and spread all over the body, and the patient moans and is low-spirited, and his abdomen is inflated and resonant like a drum, it is a fatal sign."

(27.) He also says:—"The symptoms of the Small-Pox are a continued fever, redness of the eyes and cheeks, and restlessness in sleep."

(28.) He also says:—"You should make a collyrium for the eyes with rose water, in which sumach has been infused, in order to prevent any pustules from breaking out in them."

(29.) In order to strengthen the eyes, you should make use of a collyrium of sumach and pomegranate flowers prepared with rose water.

(30.) After the pustules of the Small-Pox are come out, drop into the eyes some cuhl rubbed up in an infusion of dry coriander, and then strained, with a little common camphor; or else rubbed up in rose water.

(31.) You should endeavour to bring out the pustules as

quickly as possible, in order to prevent palpitation of the heart, syncope, and sudden death.

(Form. 23.) Take of Lac, five drachms,

Peeled Lentiles washed, seven drachms,

Gum Tragacanth, three drachms;

Boil them in half a pint of water, until only the half of that quantity remains; then give it the patient to drink.

(32.) Let the patient's food be Indian peas and lentiles peeled, boiled in pomegranate water. In the winter let a fire be lighted of the wood of the tamarisk, oak and vine, and when the pustules begin to dry up, paint the parts with a feather dipped in the meal of rice and millet, and a little saffron, dissolved in rose water.

(33.) If any pustules come out in the nostrils or in the mouth, drop into the nose oil of violets, white wax, and gum tragacanth, and into the mouth mucilage of fleawort seed. With respect to diet, put into the patient's drink troches of broadleaved dock, and let his food be parched barley meal with pomegranate water; and do not give him young birds to eat until the fever is entirely gone, the pustules dried up, and the scabs fallen off.

(34.) At the beginning of the disease let the patient be fed on pot-herbs; and for the first week let his bowels be kept open with "Aqua Fructuum"; and let him have for drink barley water as long as the acrimony continues. After the end of the first week take care not to give him anything that is laxative; for towards the end of this disease a diarrhoea sometimes comes on, accompanied with ulceration of the intestines; and let his food be peeled lentiles boiled in pomegranate water. And do not put oil on the patient either in the beginning of the disease or towards the end, for in the beginning it hinders the eruption of the pustules, and towards the end it renders the ulcers corrupt.

(35.) Serapion says:—"As soon as the symptoms of the Small-Pox appear, the patient must lose blood, either by the lancet, or, if his strength be much reduced, by means of cupping-glasses. When the eruption begins to come out care must be taken of the eyes, and before any pustules appear in them drop into them rose-water in which sumach has been boiled, or the juice of the pulp of pomegranates; and if any pustules should come out in

them then drop into them cuhl rubbed up in fresh coriander water, or in a decoction of dry coriander in rain water. Let the patient have to drink a decoction of far and lentiles and figs in order to hasten the eruption; and when the pustules begin to come out give him barley water with a decoction of peeled lentiles. Let him not eat young birds until the fever is quite gone, and the pustules dried up; but let his food be Indian peas, lentiles, and pot-herbs."

(36.) Simple medicines which remove the marks of the Small-Pox:—Radish seed, bean meal, soft earth, asses' fat, chips of the wood of the willow tree, old bones, dried reed roots pulverized, prickly salt-wort preserved with dried melon seeds, litharge, saffron, bastard sponge, white of egg, barley water, oil of lilies, sal prunella (?), gum ammoniacum, frankincense, soap, white sugar candy, wheat starch, sweet and bitter almonds, sweet costus, sarcocol; besides the frequent use of the bath, and the drinking sweet pomegranate water.

(37.) From Ibn Macawiah: "An admirable medicine for removing the marks of the Small-Pox:—

(Form. 24.) Take of old white Dung, (?)

Burnt Bones, of each ten drachms,  
 Reed Roots dried, twenty drachms,  
 Fresh common Cress,  
 Wheat Starch, of each ten drachms,  
 Lupines, five drachms,  
 Melon Seed,  
 Washed Rice,  
 Common Chick Peas, of each ten  
 drachms,  
 Ben Seeds,  
 Costus,  
 Long Birthwort, of each five drachms;

Rub them in Barley water or Melon water, and anoint the body with it, and let the patient be washed next day with a decoction of Violets and Barley."

(38.) Another medicine for removing the marks of the Small-Pox:—

(Form. 25.) Take of old Bones,  
Persian Reed roots,  
Fresh common Cress,  
Wheat Starch,  
Lupines,  
Melon Seed,  
Common Chick Peas,  
Washed Rice,  
Ben Seeds,  
Costus;

Rub them in Melon water, and anoint the patient with it.

(39.) A plain and simple liniment:—

(Form. 26.) Take of peeled Melon Seed,  
Sweet Almonds peeled,  
Rice Meal,  
Common Chick Peas,  
Old Bones,  
Preserved (?) Litharge;

Rub them in Melon water or Barley water, and anoint the patient.

(40.) I once saw a person with the Small-Pox, who was washed with salt and water, and afterwards swelled, and suffered great pain, because the pustules were not ripened. It is better that they should be dried up when necessary with a considerable quantity of common camphor dissolved in rose water; and let the patient sleep upon millet meal, willow leaves, and roses both dried and fresh; in summer, when there is much heat, light a fire with sanders, and in winter with tamarisk, myrtle leaves, and willow leaves.

(41.) Before the Small-Pox comes out it is better to drop into the eye rose water with common camphor or sumach, or the pulp of pomegranates, or something of the same nature. And if any pustules should come out in the eye, let some cuhl be rubbed up in rose water with coriander, common camphor, and Nabathacean caviare without vinegar. By this means you may prevent the pustules from coming out in the eye.

(42.) Oil must be applied when the pustules are dried and be-

come eschars, and it is then very useful in causing them to fall off quickly; but before this time it should not be used.

(43.) The pustules are a species of crisis, and for this reason the eruption is not to be checked, for that would be like checking the crisis, and might make the disease fasten upon some of the more important organs; and therefore, when you see symptoms of the pustules, you may be sure that Nature is inclined to throw out the humour to the surface of the body, and I should aid her in this attempt by giving the patient suitable things to drink; and do not let the room in which he is placed be very cold, for this would hinder the eruption from coming out by obstructing the pores of the skin. It is necessary to examine the reason why this crisis occurs especially in children. And when the pustules appear on a critical day, and are quick in ripening, it is a favorable sign; but when they appear on a bad day, and are slow in ripening, it is unfavorable. The worst kind is that in which the pustules break out on the second or the sixth day, and in which the fever is not alleviated by the eruption.

(44.) Women employ lily leaves for drying the pustules, and I have seen them succeed extremely well. But salt and water is still more efficacious, when it does not occasion the patient much smarting pain; and this will not be the case when it is applied to those parts of the body which are not excoriated. Oil takes away the eschars; and the red plaister is very useful in removing the scars that are called the pock-holes. I have seen many people give a patient dates to eat when the Small-Pox begins to appear; but this is a very dangerous mistake.

(45.) I have found by experience, that, when the pustules have begun to come out, nothing is more injurious than lettuce, blood-letting, and drinking snow-water; for the patient should not drink what is cold, nor be exposed to cold air. I have seen a person treated in this manner, and there came on a palpitation of the heart with excessive swooning.

(46.) A female patient had the Small-Pox, with pustules that were small, hard, and warty, but not black; she had also a difficulty of breathing, and violent inflammation of the bowels; and she died. Patients often die of syncope, with shortness of breath, and coldness of the extremities.

(47.) Sometimes the Small-Pox sinks inwards, and is so like the Measles that it is afterwards said that the Measles are turned into the Small-Pox. The difference between the two I have found to be, that the Measles are red, and appear only on the surface of the skin, without rising above it, while the Small-Pox consists of round eminences. When these eminences appear, fix your attention on them, and if you are in doubt as to the disease, do not express any opinion about it for a day or two; but when there are no eminences, you must not give as your opinion that the disease is the Small-Pox.

(48.) A liniment which has been found by experience to remove the marks of the Small-Pox:—

(Form. 27.) Take of the Meal of common Chick Peas, ten drachms,  
Lupine Meal, three drachms,  
Sweet Costus,  
White Litharge,  
Pepper-corns, of each one drachm;

Pound all of them together with barley-water.

(49.) Ishak Ibn Honain says:—"As soon as many pustules have come out, you should commence the treatment by taking away blood either by the lancet or by cupping-glasses, until swooning comes on; and let the patient take barley-water. If his bowels are relaxed give him barley-gruel, especially in the Measles, which disease is often accompanied by a diarrhoea; and let him avoid all sweet and thick food."

(50.) From Mosih (?):—"A medicine that removes the marks of the Small-Pox:—

(Form. 28.) Take of Wheat Starch,  
Peeled Almonds, of each two parts,  
Sweet Costus, half a part,  
Reed Roots, four parts,  
Melon Seeds not (?) peeled,  
Peeled Beans,  
Barley,  
Saffron, of each three parts  
Gum Tragacanth, half a part;

Strain through (?) a piece of silk, and anoint the scars with a



feather; leave it during the night, and wash them the next day in a decoction of chamomile, melilot, and violets; if GOD permit."

(51.) "A medicine which brings out the Small-Pox to the surface of the body:—

(Form. 29.) Take of White Eggs, to the number of five,  
 Stoned Raisins, ten mithkals, (1½  
 drachm)  
 Lac, washed and cleansed from its  
 stalks, five drachms,  
 Gum Tragacanth, cleaned, two mith-  
 kals,  
 Saffron, five mithkals;

Boil them in three pints of water until only one pint remains; let the patient drink one third of a pint every day for three days; if GOD permit."

(52.) I have found the peculiar symptoms of the Small-Pox to be, a continued fever, pain in the throat, and, in the beginning of the fever, pain in the back; the patient lies on his back, moves his feet up and down, is restless, and disturbed. You must be cautious as to blood-letting, and the circumstances under which you employ it.

(53.) Georgius says: "The Measles arise from blood with which is mixed a great quantity of yellow bile, and the Small-Pox from gross blood mixed with much humidity; and therefore the latter disease is moist, and the former dry. They occur for the most part in the autumn, when there is no north wind, nor any rain, but the air is turbid, dusty, and obscure, with continued south winds. The symptoms are these: a continued fever, headache, pain in the back, heaviness of the head, redness of the eyes, pain in the throat and chest, dryness of the mouth, thick spittle, itching of the nose and sneezing, fulness of the face, difficulty of breathing, nausea, want of appetite, stretching and uneasiness, and starting in the sleep. The best and most salutary crisis that can take place in these diseases is bleeding at the nose. When the Measles and Small-Pox are of a violet or black colour, and they sometimes appear and then sink in again, and there

comes on great anxiety, and hoarseness of the voice, and delirium, the patient will hardly recover from them. As to those pustules which are dry and contain no fluid, but are warty, and with the skin cracked, and accompanied by great anxiety, difficulty of breathing, delirium, and loss of voice, they are fatal. Sometimes small pustules are found inside large ones, and they are then called 'doubled pustules.' The marks of the Small-Pox are removed by powdered reed roots, chips of the wood of the willow tree, and white litharge.

(54.) Galen describes a plaister in the first book of his treatise *κατὰ γένος*, which is useful in many diseases, and then adds, "and also in the Small-Pox;" from which passage you may know that he was certainly acquainted with this disease. He also mentions it again in the second book, and says, "a plaister which is useful in different diseases, and in the Small-Pox;" and this plaister he quotes from Andromachus, who lived before Galen. And again in the fourth book of "Timaeus" Galen says that "the ancients applied the name *φλεγμονή* to everything in which there was inflammation, as the erysipelas, Small-Pox, and fever, and that these diseases were in their opinion generated from bile." He mentions it also in his treatise "On Pulses," and in the beginning of the ninth book of his treatise "On the Use of the Members" he says that "the superfluous parts (of the food) which are not converted into blood, putrefy in process of time, and become acid, until they are generated from it the erysipelas and the Small-Pox.

(55.) I have found upon examination that the amount of danger in the Small-Pox may be estimated by the difficulty of breathing and hoarseness of voice, and that many persons die of suffocation; and therefore I think you should begin at once with taking care of the throat, at the commencement of the attack with styptic remedies, towards the end with lenitives and laxatives.

(56.) In the hospital I have found that in the Small-Pox and Measles you should use blood-letting before the fourth day and after it, and especially before all the symptoms appear; after which time you will not be forced to use this remedy, but may lay

it aside until the patient's strength be restored, unless the morbid matter be very great, in which case blood-letting may be used, but sparingly.

(57.) Those who die in this disease die on account of the excess of the morbid matter, and because Nature is not able to throw it all out on the skin. It is useful to take blood from the veins of the nose at the commencement of the disease; for I have seen several persons recover in consequence of bleeding at the nose. The Small-Pox for the most part attacks children, who cannot bear blood-letting. When you see the autumn is hot and dry, and the winter the same, you may expect the Small-Pox to prevail until there is plenty of rain.

(58.) A patient that has the Small-Pox should be well wrapped up when the pustules are coming out, and carefully avoid the cold and the breathing cold air; by which means he will recover. And if it be summer time, he should not be put in an airy room, but in a place where he may be made to sweat, unless a fainting fit should come on; in which case sweating should be avoided, and the patient placed in an airy room, and smell sanders, rose-water, and camphor. He should not use cooling drinks or regimen until the pustules have fully come out; after which time he should not lose blood, unless the morbid matter be very great, for this would repel it into the interior, and hinder the crisis that Nature is trying to bring about.

(59.) Maserjawaih says: - "He who hinders the pustules from coming out in the eye, or, if any should appear, disperses them and prevents their doing any injury, is a skilful physician."

(60.) Ibn Masawaih says: - "The inspissated juices of warted-leaved rhubarb, juice of unripe grapes, and acid juice of citrons are useful against the Small-Pox, Measles, and pestilential ulcers, because they subdue the acrimony of the yellow bile, and act as extingnents to the blood."

(61.) When the pustules begin to appear, and have reached the eye, you should drop into it cuhl, when there is any fear of a copious flood of tears; in this case you should drop into the eye a collyrium composed of cuhl, haematite, and acacia. Oil should not be applied until the ulcers are dried, in order to promote the

falling off of the eschars; for before that time it is dangerous to use it, as it hinders their drying off, and thereby occasions palpitation of the heart and fainting: some physicians, however, make use of it.

(62.) I have sometimes seen the Measles appear in a person after the seventh day from the beginning of the fever, and without any of the symptoms of the Small-Pox and Measles, except a constant vehement distress and nausea. And when you see the patient affected with a continued fever, and anxiety, and a constant vehement inquietude, you may be sure that these are more especially the symptoms of the Measles; and in this case the surface of the body is not to be cooled.

(63.) In the fourteenth book of his treatise "On Pulses" Galen says that "the blood is putrefied in hot tumours, Small-Pox, and gangrene, in an extraordinary degree, and that the inflammation runs so high that the skin is burned, and there break out in it the Small-Pox, gangrene, and the like." And in the ninth book of his treatise "On the Use of the Members" he says that "the superfluous parts of the food that remain, which are not converted into blood, and remain in the members, putrefy and become acid in time, until there are generated the erysipelas, Small-Pox, and spreading inflammation."

(64.) Galen mentions the Small-Pox, but not any peculiar mode of treatment; he considers the disease to be a species of crisis.

(65.) If a person has a pain in the back, without any other symptom of the disease, and the bowels are relaxed and the urine white, he is going to have the Small-Pox. And in short, there is no more characteristic symptom of the Small-Pox than pain in the back with fever; so that when you see this happen in the autumn you may be sure that the Small-Pox is about to appear rather than the Measles, for the Measles are not attended with pain in the back. The reason of this depends, I think, on the violent distension of the vena cava, which extends along the vertebrae of the spine; for in the Measles this vein is not distended because the disease arises rather from the bad quality of the blood than from excess in quantity, while on the other hand

in the Small-Pox the quality of the blood is not very much deteriorated, compared with the Measles.

(66.) In the Small-Pox there is much superfluous humour, and therefore you must beware, and endeavour to bring out the eruption to the surface; and if the patient be not hot, let him be treated with such medicines as are warming, and omit such as are extinguent. But if the tongue is black, and the heat increases, then do not treat him in this way. Care must be taken of the throat, which is often affected with quinsy and suffocation; and the patient should make use of a styptic gargle, and afterwards, if the pain be violent, warm water and sugar-water. When the pustules are slow in ripening, the body may be fomented with the steam of a decoction of chamomile.

(67.) Those pustules which appear in a circular form with their summit concealed *viz* are of a bad and mortal kind. When pustules come out on the eyelids wash them with a collyrium composed of red horn poppy, rivet, aloes, and saffron; and drop into the eyes rose-water with rumack.

(68.) There was a patient who had a severe attack of a bad kind of Small-Pox; so we had him bled before he felt much suffocation in his throat, and there was no extinguishing medicine which we did not give him. Accordingly, his throat began to be less constricted, and he was getting better from the Small-Pox, so that we had good hopes of his recovery; when suddenly there came on a great perturbation of the humours, and the patient was seized with a very acute pain in his leg, and the pustules turned black, and he died of the violence of the pain that same day. I had intended to scarify his leg in that part, but his strength began to sink within an hour, so that I had no hope of saving him, and at last he fell into such a state that blood oozed from the pores of his skin. I have seen several patients in whom a large sort of pustules came out, and who had towards the end of the disease a pain in the leg.

(69.) Lac should be given to drink in the Small-Pox, in order to strengthen the liver.

(70.) At-Tarmadi says:—"When the pustules break let them be anointed with oil and salt; and let the patient stand in the sun

for the space of an hour, and afterwards be washed in a decoction of figs and myrtles, and fumigated with tamarisk; then after three days let him be rubbed with a liniment, made of white bole and a little salt, which is to remain on him for half a day, and then to be washed off as before. When the pustules are dried up give the patient camel's milk to drink, and when his body is ulcerated sprinkle under him a white aromatic powder."

(71.) Bachtishwa says:—"The symtoms of the Small-Pox are fever with redness of the face and body, and especially an intense redness of the gums; at the commencement of the disease if the pustules are raised like berries, it is the Small-Pox, but if the red places are nearly level with the surface of the body, it is the Measles. The treatment of both diseases is the same: at the beginning give the patient every day ten drachms of vinegar with four grains of musk, if the eruption be plentiful, and if it be less copious then give it in proportion. After three days give him the following medicine:—

(Form. 30.) Take of cleansed Roses, four drachms,  
Peeled Lentiles, four drachms,  
Lac, two drachms;

Boil them in two pints of water until half a pint remains; strain it, sweeten it with sugar, and give it the patient to drink on an empty stomach during three or more days."

(72.) He then proceeds in almost the same words as At-Tarmadi:—"When the pustules break, take two drachms of (oil of?) sesamum, add to it a little burnt (Andarene) salt, and with this anoint the patient's body; let him stand in the sun for the space of an hour, and afterwards be washed in a decoction of the leaves of myrtles, roses, and pomegranate flowers, with a little salt; then let him be fumigated with the leaves of myrtles and tamarisk, and after two or three days let him be rubbed with a liniment made of white bole and a little salt, which is to remain on him for half a day, and then to be washed off as before. When the scabs fall off, take some rice, wash it and dry it, then pound it, put it with a little saffron, and mix it with water; anoint the patient with it, and leave it on him for half a day. If his body be ulcerated, sprinkle under him a white aromatic powder; and

when the pustules begin to dry up, give him camel's milk to drink. If his bowels are relaxed, give him barley-gruel and rice with gum Arabic. If the patient swells and has abscesses form, and his voice becomes hoarse, and the dryness (?) be great, and this happens on the seventh day, the end will be fatal; and if the pustules be black or of a very deep red colour, it is an equally bad sign.

(73.) For the mode of treating the scars and marks of the Small-Pox the reader may consult the chapter on that subject.

(74.) The stale urine of a man is useful in the Measles. If you macerate sumach in rose-water, and use it as a collyrium in the Small-Pox, it will strengthen the pupil of the eye, and prevent any pustules coming out in it.

(75.) A medicine which quickly brings out to the surface of the body the Small-Pox, Measles, and all kinds of pustules:—

(Form. 31.) Take some dried Figs,  
                     Stoned Raisins,  
                     Lac cleared from its stalks,  
                     Gum Tragacanth,  
                     Saffron,  
                     And peeled Lentiles;

Boil them in water, and let the patient drink the decoction.

(76.) From the "Liber Memorialis" (or "Register?") of 'Abdus:—"Medicines, whose author is unknown, which are wonderfully efficacious in removing the marks of the Small-Pox:—

(Form. 32.) Take some Lupines,  
                     Common Chick Peas, black,  
                     Burnt shells,  
                     And burnt Cow-dung;

Mix them up in water, and smear it on the face.

(77.) "Or take equal parts of barley and sheep's dung, soak the barley in water till the husks come off, then bruise them, and mix them up with red vinegar, and smear it on the marks of the Small-Pox.

(78.) "Or take the water which is in the hoof of a roasted ram, wash the parts with it, and it will remove the marks.

(79.) "Or, take asses' grease, mix it with oil of roses, and smear it on the parts."

(80.) Ibn Masawaih says:—"When there is with a continued fever a redness of the eyes and face, much heaviness of the body and head, itching of the nostrils, sneezing, and a pricking pain all over the body, these are signs of the eruption of the Small-Pox. Your first care should be directed to the eye, for which you should use a collyrium made of sumach and rose-water, in order to prevent any pustules from coming out in it. After the appearance of any pustules drop into the eye cuhl rubbed up in a decoction of dry coriander in warm water, with the addition of a little camphor after it is strained. And in order to bring out the eruption of the pustules quickly, and without any palpitation of the heart or nausea, let the patient take the following medicine:—

(Form. 33.) Take of Lac five drachms,

Lentiles, peeled and washed, ten  
drachms,

Gum Tragacanth, three drachms;

Boil them in half a pint of water until only the half of that quantity remains; then strain the liquid, and give it the patient to drink.

His food should be such as is given in cases of acute disease; and the bowels should be kept open, if necessary, during the first week, with "Aqua Fructuum" but after that time you should avoid opening the bowels, and rather let his food incline to such as is astringent, because a diarrhoea sometimes ensues. In the winter light a fire of tamarisk, vine and oak; and when you see the pustules are drying up, smear the body with a feather dipped in a mixture made of rice meal and millet with a little saffron in rose-water. If any pustules come out in the nostrils, drop into them cerate made with oil of violets; and treat the mouth in the same way. The patient should not eat young birds until the pustules are dried up and no fever remains. Do not apply oil to the patient's body either in the beginning of the disease or towards the end, especially in the beginning, because there is some fear of its driving the eruption inwards, and hindering the breathing, so as to occasion palpitation of the heart and death."

(81.) Al-Yehudi says:—"Yellow boils indicate the presence of yellow bile, and those that are greenish and black indicate a vehement adustion of the blood; and these latter are mortal.



The same may be said of the Small-Pox. When the fever commences with heat, head-ache, pain in the throat, cough, redness of the face and eyes, sneezing, itching of the nose, and perspiration about the body, the Small-Pox will certainly come out; and this happens for the most part on the third day, when the fever is mild, and sometimes it breaks out on the first or second. The Measles are less elevated than the Small-Pox, and the Small-Pox is more injurious to the eye, especially when the pustules are small and close together. Rub up cuhl in milk, and then make it into a collyrium with camphor. On the seventh day sprinkle on the patient water with salt and a little saffron, and afterwards roses, sanders, lentils and a little common camphor. At the commencement of the disease he should not drink anything cold, for this would retard the superfluous humours and hinder their coming out speedily; but let him have sweet fennel-water and smallage-water, and sugar, in order to hasten the eruption from the interior; and let him rinse his mouth with pomegranate juice in order that he may have no pain in his mouth and throat, and that no pustules may come out in them. After their appearance let him take troches of the roasted seed of broad-leaved dock and flea-wort; and if his throat be in pain, give him butter. In the winter let there be constantly kept in his room a fire lighted with tamarisk, and when the pustules abound with too much moisture, let him sleep upon a mattress of fine texture stuffed with rice meal. The pustules which come out after the fever are less dangerous than those which precede it. In the Measles the saliva is thick, the eye and face red, the tongue dry, the veins of the forehead turgid, and there is nausea: and the Measles come out all at once, but the Small-Pox gradually. The Measles that are violet coloured or green are fatal, especially if they sink in suddenly, and the patient is seized with anxiety and swooning; so be on your guard. In the Small-Pox, when the pustules are black, dry, numerous, covering almost the whole body, and warty, the disease is fatal. When the pustules are moist let them be fumigated with myrtle leaves; and wash the marks of the Small-Pox with powdered reed roots in water, and powdered willow stalks, and litharge."

(82.) Georgius says:—"The small-Pox and Measles break out when blood has not been taken from the patient for some time, and it is corrupted, and much inflamed, and especially when the south winds prevail. They are preceded by an acute fever, with violent pain and heaviness of the head, redness of the face, cough, dryness of the tongue and saliva; the veins of the whole face are swollen and inflated; the saliva is thick and viscid; and there comes on an itching of the nose, sneezing, redness of the eyes, with itching and a flow of tears, and puffiness of the face; the breathing is impeded, and there is disturbance of mind, vomiting, loss of appetite, and a feeling of heaviness in the whole body. When you see these symptoms, or part of them, the Small-Pox or the Measles will certainly appear. And sometimes when they appear the fever is obstinate, and the disease is more violent and difficult to treat; and at other times when they appear, the fever is diminished: the Measles are less elevated than the Small-Pox. You should not treat these diseases with very cold remedies, for this would be injurious; but, if it be winter, give the patient the expressed juice of sweet fennel and smallage, and rosed honey; and if the season be warm, give him barley-water, lentils, melons, pomegranates, and the like. Let him keep in his mouth every day the expressed juice of sweet fennel, with saffron, and white sugar-candy; drop caviare into his eye, in order to prevent the pustules from coming out in it, and use a collyrium of antimony and common camphor. He is not to eat acid or salt food, or condiments, for fear of bringing on cough and thirst, nor the julep, that his bowels may not be relaxed; and if any diarrhoea should come on, give him the inspissated juices of myrtle and quinces in cold water, with troches of tabasheer. If bleeding at the nose comes on, it is a favorable crisis. When you see the Measles of a violet or greenish colour suddenly sink into the interior of the body, you may be sure that swooning will come on and that the patient will die. When the pustules of the Small-Pox are small, dry, close together; when they are not soon filled with fluid, or not at all; and when they are hard like warts and break; there comes on swooning, anxiety, and delirium."

(83.) He also says:—"When the patient has too much moisture

in the pustules let him sleep upon a bed of fine texture stuffed with rice meal, or millet meal, and let him be fumigated with dried myrtle leaves and olive leaves. And when the ulcers are dry you should take pounded reed roots or willow stalks, mix them in water, and anoint the patient with it, or else anoint him with litharge, in order to prevent the appearance of any scars."

(84.) Ateuriscus (?) says:—"Propolis mixed with barley, and applied to the pustules, removes (?) them."

(85.) Ahrun says:—"The most curable sort (of Small-Pox) is the white and red; the most dangerous is the black, then the greenish, and next to that the yellow. When you see that the fever is lessened upon the breaking out of the Small-Pox or Measles, it is a favorable sign; but when the fever is aggravated, it is fatal."

(86.) He says also:—"When you know that the Small-Pox is beginning to break out, do not give the patient a cold medicine, which would tend to keep back the pustules in the interior; but let him have sweet fennel and smallage, in order to bring them out to the surface: and let him rinse his mouth with a decoction of lentils and sumach, in order that none may come out in his mouth and throat, and hurt them."

(87.) He says also:—"When the pustules are ripened, let the patient sleep upon rice meal, and fumigate him with myrtle and olive leaves, so as to dry them up."

(88.) The Small-Pox arises from a fermentation that takes place in the blood, when it is undergoing the change from that of an infant to that of a young man; and it is accompanied by great heat and a disagreeable odour; and this is when the patient is of a hot temperament. The disease sometimes happens twice or even three times to the same individual, but generally once, especially to males, for the blood of infants must necessarily undergo this change. Care must be taken in the spring and winter of those children who are of a habit of body disposed to the Small-Pox and Measles, that they may not be seized by an acute fever; the commotion of the blood must be quieted, and the heat extinguished as much as possible; and the food must be light, and such as generates thin blood. Take care that the pores of the

body be kept open by friction, exercise, and baths; but in the autumn and summer there is not so much occasion for this, as in the summer much of the body is dissolved, and in the autumn the blood is scanty. The children that are disposed to the Small-Pox and Measles are those that are pale, or ruddy, and fat and light haired; but those that are lean and swarthy are but little subject to them.

(89.) Ibn Serapion says:—"If the strength of the patient will allow it, nothing is better in the Small-Pox than to bleed him till he faints; but if not, then let him be cupped. Drop into his eyes a decoction of sumach or the pulp of pomegranates; and when the pustules begin to appear, give him a decoction of lac until the whole come out, after which let him have to drink barley-water and lentils, and Indian peas and the like to eat. In the winter light a fire with the wood of tamarisk and vine; and when the pustules are dry smear over him the meal of rice and millet, and the roots of Persian reeds, and saffron, moistened with rose-water."

## LIBER CONTINENS

### Lib. XVIII. Cap. 4

A female patient, who was accustomed to drink camel's milk without my advice, and had become inflated by it took some musk, without having been previously blooded or purged. Thereupon she fell into a continued fever, symptoms of the Small-Pox appeared, and after four days the pustules broke out. At the commencement of the disease she intrusted herself to me; so I immediately took care of her eyes, and strengthened them by a collyrium of cuhl rubbed up in rose-water. In consequence of this not a single pustule came out in her eyes, though they were very thick all around; so that the old women who were waiting upon her were astonished at her eyes being preserved. I made her take barley-water and the like for some time; and as her bowels were not relaxed, as is the case at the end of this disease, and she had still some remains of ardent fever, I conjectured this to be the effect of the residue of the humours that did not pass off by the bowels, as usual. I could not venture to

bring this away all at once on account of her weakness; so I made her take the "Aqua Fructuum" in the morning, and barley-water in the afternoon, for a fortnight, which occasioned two motions every day, and a complete purgation. After forty days there appeared a perfect coction in the urine, and after fifty the patient was quite recovered.

THE END





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GUILLAUME DUPUYTREN

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## Guillaume Dupuytren

### BIOGRAPHY

- 1777 Born October 5, at Pierre-Buffière, a town of Haute-Vienne, near Limoges, the son of a lawyer.
- 1789 Age 12. Taken by a cavalry officer, who had been stationed at Pierre-Buffière, to Paris where he entered the College of La Marche.
- 1795 Age 17. Appointed prosector at the École de Médecine in Paris. Had a hard struggle against poverty but remained in Paris against the wishes of his parents.
- 1801 Age 24. Promoted to position of Chef de Travaux Anatomiques. Laennec and Cruveilhier were his pupils at this time.
- 1804 Age 27. Obtained the place of surgeon of the second class of the Hôtel Dieu, attached to the service of Boyer. On the plea of the faculty of the École de Médecine, Dupuytren obtained an exemption from conscription in the army.
- 1808 Age 31. Appointed adjunct surgeon in chief of the Hôtel Dieu, under Pelletan. Before the students, Dupuytren severely criticized the diagnoses of his chief and in turn was mercilessly berated for his opinions, manners and attitudes. Percy named Dupuytren the first of surgeons and the last of men.
- 1812 Age 35. Appointed professor of operative medicine at the Hôtel Dieu and elevated to the chair of that subject on the Faculty of Medicine.

- 1814 Age 37. Appointed chief surgeon of the Hôtel Dieu.  
 1816 Age 39. Created a baron and given the Order of St. Michael.  
 1820 Age 43. Made consulting surgeon to Louis XVIII.  
 1821 Age 44. Made surgeon to Charles X.  
 1833 Age 56. While walking to his work at the Hôtel Dieu, was seized with an attack of apoplexy.  
 1834 Age 57. Forced to give up work; travelled to Italy with acclaim at each place he visited.  
 1835 Age 58. Died February 8 and was buried in Père-Lachaise. Left to medicine 200,000 francs which were used to establish a pathologic museum, the Musée Dupuytren, in Paris.

Member of the Academy of Sciences.

Member of the Royal Academy of Medicine.

## EPONYMS

CONTRACTURE—a contracted condition of the fingers and palm due to an inflammatory hyperplasia of their tissues.

ENTEROTOME—a cutting forceps used in making an artificial anus.

FRACTURE—of the lower part of the fibula, with dislocation of the lower tibial articulation and rupture of the internal lateral ligament; same as Pott's fracture.

HYDROCELE—bilocular hydrocele of the tunica vaginalis testis.

OINTMENT—a cantharides ointment, 1:80.

OPERATION—or amputation; a method of removing the arm at the shoulder joint; called also Lisfranc's amputation.

PASTE—a caustic paste of arsenous anhydrid, calomel and gum.

SIGN (1)—a crackling sensation on pressure over a sarcomatous bone.

SIGN (2)—in congenital dislocation of the head of the femur there is a free up and down movement of the head of the bone.

SPLINT—to prevent eversion in Dupuytren's or Pott's fracture.

SUTURE—a continuous Lembert suture.

TOURNIQUET—one consisting of a semicircular piece of metal with a head at one end; used for compressing the abdominal aorta.

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- Revue chirurgicale de l'hôtel-Dieu. M. Dupuytren. Ibid.  
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- Blessé par l'éclat d'un fusil. Ibid., Oct. 2, p. 4.
- L'hydrocéphale. Ibid., Oct. 6, p. 4.
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- Infibulation suivie de la dégénération squirrheuse du prépuce.  
Ibid., Oct. 23, pp. 2-3.
- Bulletin de l'hôtel-Dieu. Ibid., p. 4.
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- Calcul dans la vessie. Ibid., Oct. 30, p. 4.
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- Hernie étranglée. Ibid., Nov. 8, p. 1.
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- Note sur les diverses méthodes de débridement dans les hernies  
avec gangrène de l'intestin. Ibid., Nov. 13, p. 4.
- Pierre, calcul, taille. Ibid., Nov. 17, p. 4.
- Pierre de vessie. Ibid., Nov. 22, p. 4.
- Pierre, luxation de l'humérus, d'hydrocèle, tumeur. Ibid.,  
Nov. 29, p. 4.
- Amputation testicule gauche, tumeur, luxation, d'anus contre  
nature. Ibid., Dec. 1, pp. 1-3.
- Empoisonner avec acide sulfurique. Ibid., Dec. 11, p. 4.
- Ligature de l'artère iliaque externe, pratiquée avec succès.  
O., 3. Also, abstr.: B., 14: 239-245.
- De la dilatation de l'urètre. Reported by M. Michon. O., 3:  
119-130. Also, abstr.: B., 14: 385-392.
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102-123.

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Clinique chirurgicale de l'hôtel-Dieu. By M. Hipp Royer-Col-lard. Ibid., 239-243.

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Du phlegmon diffus. E., Jan. 1, pp. 17-19.

Plaies d'armes à feu. Ibid., Jan. 3, pp. 24-33.

Corps de poing à un carreau. Ibid., Jan. 17, p. 45.

Fractures du col du fémur. Ibid., pp. 45-46.

Opinion de M. Dupuytren sur la taille hypogastrique; opération pratiquée avec succès. Ibid., Jan. 31, pp. 70-72.

Plaie du côté gauche. Ibid., Fev. 2.

Ongle entré dans les chairs—Fongosités utérines—étrangle-ment de la verge par une bobèche du chandelier. Ibid., Fev. 26, p. 116.

Luxation dite originelle des fémurs. Hernie ombilicale étranglée; opération. Hernie crurale étranglée; opération. Ibid., Mars 11, pp. 137-138.

Fongosités naissantes du col de l'utérine deux bras. Ibid., Mars. 13, p. 144.

Hernie inguinale étranglée chez un enfant de vingt jours, opéra-tion. Ibid., Mars 25, p. 161.

Fracture de l'os malaire droit, avec dépression. Tumeurs érectiles, chez un enfant de huit mois. Étranglement de la verge, par deux anneaux de bourse. Brûlure aux cin-quième et sixième degrés, tétanos. Ibid., p. 162.

Anévrisme faux primitif de l'artère radiale à la suite d'une soignée. Ibid., p. 163.

Étranglement partiel du rectum par un pessaire en ivoire à trois branches. Ibid., Mars 27, p. 168.

Luxation de l'avant-bras en arrière. Amputation de jambe. Ibid., Mars 29, p. 172.

Hydrocèle multiloculaire, opération. Ibid., Avril 1, p. 76.

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Cas singulier de mutisme incomplet, par suite d'une commotion cérébrale. Tumeur fibro-celluleuse développée dans l'épaisseur du col de la matrice; extirpation. Ibid., Avril 10, pp. 189-191.

Tumeur fibreuse de la matrice. Opération. Ibid., Avril 17, pp. 203-204.

Tumeur fibreuse de l'utérus—Instrument de M. Colombat pour faciliter l'excision du col de la matrice. Amputation de la verge. Ibid., Mai 1, pp. 227-228.

Opération de cataracte par dépression. Taille bi-latérale. Ibid., Mai 6, p. 236.

La taille par le méthode bi-latérale. Ibid., Mai 13, p. 247.

Cancer du sein; amputation. Fissure de l'anus. Ibid., Mai 19, p. 260.

Mal vertébral de Pott. Pleurésie, empyème. Fracture de la jambe compliquée de plaie; Amputation du membre. Ibid., Mai 27, pp. 267-270.

Du délire nerveux. Ibid., Mai 29, p. 273.

Calcul vésical, taille bi-latérale. Ibid., Mai 29, pp. 276; 288.

Observations sur le cataracte—considérations générales. Ibid., Juil. 10, pp. 345-346.

Observations de hernie étranglée. Hernie inguinale étranglée par le collet du sac; débridement; entérite; mort. Ibid., Juil. 15, pp. 353-354.

Kystes à parois osseuses, développée dans l'épaisseur des os (3 cases). Ibid., Juil. 22, pp. 365-366.

Tumeurs cancéreuses du col trachéotomie. Mort. Ibid., Juil. 29, p. 372.

Anévrisme faux. Ibid., Aout 2, p. 386.

Leçon sur les kystes fibro-celluleux. Ibid., Aout 5, pp. 389-390.

De l'amputation dans les cas de gangrène par cause externe. Ibid., pp. 390; 394.

Hernie crurale étranglée depuis seize jours; opération. Mort. Ibid., 3: 2.

Tumeur squirrheuse, ulcérée et fongueuse de sein gauche. Ex-

- tirpation. Tumeur fibreuse du sein, à deux lobes. Ex-  
tirpation. Ibid., 3: 28.
- De l'excision des bourrelets hémorroïdaux. Ibid., 33-34; 42-43.
- Vice de conformation de la main-opération. Ibid., 50-51.
- De la réduction des luxations. Ibid., 57-58.
- Double cataracte congénitale chez un enfant de sept à huit  
ans. Ibid., 65-66.
- Extraction de polype muqueux. Idées de M. Dupuytren sur  
le mode de reproduction des polypes. Ibid., 78-79.
- Ostéo-sarcome de la mâchoire supérieure-opération. With Astley  
Cooper. Ibid., 81.
- Empoisonnement par l'oxide blanc d'arsenic. Ibid., 153.
- Injury in dorsal region, engorgement des ganglions cervicaux,  
hernie inguinale droite-congénitale. Anévrisme de l'artère  
iliaque externe. Ibid., 163-164.
- Affections syphilitiques. Ibid., 171-172.
- Opération de la taille—circonstances extraordinaires. Mort.  
Ibid., 175-176.
- Anévrisme de l'artère iliaque externe. Anévrisme de l'artère  
fémorale. Ibid., 187-188.
- Maladies des yeux. Ibid., 196-198.
- Maladies de la colonne vertébrale. Ibid., 199-201.
- Mutilations volontaire des organes genitaux. Ibid., 208-209.
- Variétés d'hydrocèle. Opération modifiée. Ibid., 211-212.
- Anévrisme faux de l'artère humérale. Opération. Résultat.  
Ibid., 223-224.
- Anévrisme guérié. Suicide, plaies du coureur. Ibid., 239-240.
- Discours prononcé à l'ouverture du concours pour une place de  
chirurgien du bureau central des hôpitaux. H., 1: 69-72.
- Calcul—vessie bilobée. Tentatives infructueuses de lithotritie.  
Opération de la taille pratiquée avec succès. Ibid., 99-101.
- Erysipelas phlegmonodes treated by Dupuytren. Note. K.,  
1: 316.
- Lithotomy. Note. Ibid., 317.
- Cas rare. Tumeur carcinomateuse pédiculée, et située dans  
la cavité de la vessie, avec chate de la matrice. L., 1: 3.
- Des tumeurs fibro-celluleuses de l'utérus. Ibid., 17-18.

- Tumeur squirrheuse de l'orbite, dont la transparence est cause d'une erreur dans le diagnostic. Ibid., 26-27.
- Calcul présumé très-volumineux. Taille recto-vésicale, combinée avec la taille bilatérale. Extraction du calcul impossible dans le première séance. Ibid., 33-34; 46-47.
- Anévrisme de l'artère fémorale. Ligature de cette artère à la distance de près d'un pouce de l'artère profonde. Ibid., 50-51.
- Anévrisme de l'artère brachiale au pli du coude; ligature de ce vaisseau au tiers inférieur du bras. Ibid., 58-59.
- Hernie étranglée; opération adhérente intime du sac, avec l'intestin; lésion cet organe. Ibid., 77.
- Anévrisme de l'artère iliaque externe, hypertrophie du coeur, rupture du sac anévrisimal; mort. Ibid., 83.
- Brûlure dénudation de la peau, flux menstruel s'opérant pas cette plaie. Ibid., 85.
- Mémoire sur une méthode nouvelle pour traiter les anus accidentels. M., 1: 259-316.
- Traitement curatif de la ranule ou grenouillette. O., 5. Also, abstr.: B., 17: 69-76.
- Mémoire sur la dépression latérale des parois de la poitrine. O., 5: 110-119.
- Clinique chirurgicale de l'hôtel-Dieu par M. G. Breschet. Ibid., 120-135.
- Mémoire sur les anévrismes qui compliquent les fractures et les plaies d'armes à feu, et sur leur traitement par la ligature pratiquée suivant la méthode d'Anel. Ibid., 217-239. Also, abstr.: B., 17: 408-415.
- De la hernie étranglée. Par M. Heulhard. O., 5: 240-253.

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- Anévrisme vrai de la sous-clavière droite, opéré d'après la méthode de Wardrop; mort le 9<sup>e</sup> jour après l'opération. Reported by Genest. B., 7.s., 20: 566-573. Also, abstr.: K, 2: 447; 478-479, 541.
- Hernie crurale opérée; Anus contre nature: Guérison des varices. Traitement. E., 3: 255-256; 260-261.

- Polypes du nez et de l'oreille-nouveaux instruments. Ibid., 280-281.
- Difformité congénitale de la jambe, amputation de membre. Mort le quinzième jour. Pneumonie lobulaire. Tubercules. Pleurésie. Phlébite. Ibid., 311-312.
- Ophthalmie blennorrhagique. Traitement spécial par le calomel et le laudanum. Ibid., 319-320.
- Relevé des opérations chirurgicales pratiquées dans le service de M. Dupuytren (salles Sainte Agnès, Saint Jean et Saint Come) pendant l'année, 1827. Ibid., 326-333.
- Hernie inguinale droite; double étranglement au collet du sac. Opération. En voie de guérison. Ibid., 347-348.
- Sur l'état du service médical and chirurgical de l'hôtel-Dieu de Paris. En chirurgie. M. Dupuytren et les salles Saint Come, Saint Jean et Sainte Agnès. 153 lits. Ibid., 350.
- Réductions des hernies. Divers moyens employés pour y parvenir. Comparaison des résultats obtenus à l'hôtel-Dieu et dans la pratique civile. Ibid., 365.
- Anévrisme vrai de l'artère poplitée droite (etc.). Ibid., 395.
- Complément d'observations de varices, de polypes du nez, d'ophthalmie blennorrhagique et de hernies. Ibid., 4: 2-3.
- Tumeur fibreuse dans la cavité du col utérin: (etc.). Ibid., 30-31.
- Difformité des lèvres; bourrelets saillants sans la muqueuse. Traitement. Oedème chronique des paupières, excision de la peau. Tumeurs enkystées. Traitement simple. Ibid., 34-35.
- Syphilis; paralysie du nerf facial, (etc.). Ibid., 50-51.
- Cas rare, tumeurs de la région temporale. Ibid., 52.
- Luxation de l'avant bras en arrière et en dehors. Ibid., 54.
- Fracture verticale de la rotule. (etc.). Ibid., 61.
- Abcès phlegmoneux aigus ou chroniques dans la fosse iliaque. Ibid., 85.
- Fistules lacrymales, causes diverses. Moyens thérapeutiques (etc.). Ibid., 105-106.
- Anévrisme faux primitif de l'artère radiale. Opér. Anévrisme vrai de la sous-clavière droite. Ibid., 117; 121.



- Résumé des huit observations de Wardrop. Étude comparative de ces faits. Ibid., 137.
- Fracture de l'extrémité inférieure de l'humérus. Luxation du coude en arrière (etc.). Ibid., 181.
- Fracture de l'extrémité supérieure de l'humérus. Luxation de cet os. Ibid., 295-296.
- De l'emploi de la méthode de Foubert, modifiée par M. Dupuytren, dans la fistule lacrymale. F., 1: 31.
- Considérations pratiques sur les tumeurs du sein; par M. Dupuytren. Ibid., 50-51.
- Nouvelle espèce de luxation de l'extrémité supérieure de l'humérus (Clinique de M. Dupuytren). Ibid., 54-56.
- Modification de la canule de M. Dupuytren pour la fistule lacrymale. Ibid., 56.
- Fongus hématode dans l'épaisseur du sein gauche—extirpation. Ibid., 97.
- Tumeur située dans la fosse iliaque interne droite et simulant un anévrisme de l'artère fémorale. Ibid., 98.
- Tumeur fibreuse développée dans l'épaisseur de l'os maxillaire inférieur—extirpation. Ibid., 98.
- Fistule vésico-vaginale. Ibid., 173.
- Syphilis. Ibid., 233.
- Fracture de la sixième vertèbre cervicale—compression de la moelle. Mort 25 jours après l'accident. Ibid., 237-239.
- Hydarthrose énorme du genou (etc.). Ibid., 251.
- Suite de l'observation d'anévrisme de l'artère sous-clavière (etc.). H., 2: 15-17.
- Considérations pratiques et observations sur la fracture de l'extrémité inférieure du radius et sur le prétendu luxation du carpe en arrière, par suite, d'une chute sur la partie antérieure du poignet. Ibid., 4: 33.
- De la gangrène spontanée. Ibid., 38-41.
- Considérations pratiques sur l'emploi du cautères et des moxas. Ibid., 41-42.
- Polype fibreux vaissant de la base du crâne. Considérations sur la composition des tumeurs fibreuses en général (etc.). Ibid., 65.

Considération pratiques sur la fracture de l'extrémité inférieure de l'humérus. Ibid., 65-72.

Reflexions sur l'emploi de la méthode de Foubert, modifiée par M. Dupuytren, dans la fistule lacrymale et sur ses résultats. Nouvelle espèce de luxation de l'extrémité supérieure de l'humérus. Ibid., 193-197.

Anévrisme de la crosse de l'aorte faisant saillie dans la poitrine et au-dessus de la clavicule du côté droit. Kyste laiteux ou butyreux dans le sein droit. Observation d'un kyste séreux contenant de petits corps blancs présumés organisés. Ibid., 225-233.

Tumeurs dans l'épaisseur du sein gauche. Fongus hematode. Réflexions sur la nature du fongus hematode et son traitement. Tumeur située dans la fosse iliaque interne droite et au-dessus de l'arcade crurale, et simulant un anévrisme de l'artère fémorale. Ibid., 294-299.

Tumeur fibreuse développée dans l'épaisseur de l'os maxillaire inférieur. Nécrose d'une portion de l'os maxillaire inférieur. Réflexions—Fongus hématode—amputation de la mâchoire. Ibid., 464-477.

Trois calculs vésicaux. Ibid., 481.

Du procédé de la rhinoplastie appliqué à d'autres parties du corps pour la guérison de difformité ou infirmités, suite de diverses maladies. Affection gangrèneuse de la bouche. Ibid., 5: 108-117.

Hydrocèle en kystes du cordon des vaisseaux spermatiques. Ibid.,

Fistule vésico-vaginale. Ibid., 252-258.

Tumeur fongueuse de la dure mère—lithotome double. Ibid., 316-321.

Hernie intestinale dans la tunique vaginale du testicule non descendue dans les bourses. Ibid.

Tumeur carcinomateuse naissante de l'apophyse montante de l'os maxillaire supérieure. Ibid., 514-520.

Extensive wound of the neck. Treated by Dupuytren. Note. K., 2: 346.

Luxation en arrière de la 1<sup>re</sup> phalange du pouce. L., 1: 109-110.

- Extirpation d'une tumeur carcinomateuse enkystée. Ibid., 124.
- Ulcères, varices aux jambes; ligature de la veine saphène interne. Ibid., 141-142.
- Hernie ombilicale irréductible; opportunité de l'opération. Ibid., 158.
- Cancer noir. Ibid., 173.
- Anévrisme de l'artère poplitée; opération. Ibid., 193.
- Anus contre nature. Hernie ombilicale, etc. Ibid., 201-202.
- Tumeur fongueuse. Ibid., 245-246.
- Tumeur carcinomateuse, par récurrence, à la cuisse. Extirpation. Ibid., 274.
- Anus contre nature. Hernie crurale étranglée. Ibid., 297.
- Néphrite, calcul et catarrhe vésical; emploi de la pince d'Astley Cooper. Ibid., 306; 310.
- Blessure profonde du cou pénétrant jusqu'au pharynx (etc.). Ibid., 321-322.
- Érysipèle phlegmoneux du bras gauche. Ibid., 327.
- Explosion d'une arme à feu dans l'intérieur de la bouche: déchirures aux parties molles: fracture de l'os maxillaire inférieure. Blessure profonde du col. Fistule vésico-vaginale. Ibid., 331.
- Rétrécissement de la partie inférieure de l'oesophage, extraction d'un corps étranger. Ibid., 334.
- Explosion d'un pistolet dans la bouche; fracture de l'os maxillaire inférieur. Ibid., 354. Also: Diplopie, p. 354.
- Hôtel-Dieu. Service de M. Dupuytren. L., 1: 378.
- Anévrisme de l'origine de l'artère axillaire, et peut-être de la fin de la sous-clavière; ligature au-devant de la tumeur. Ibid., 389.
- Anévrisme de l'artère axillaire droite (1); ligature entre la tumeur et le système capillaire. Mort indépendante de l'opération. Ibid., 2: 13.
- Hernie inguinale par récurrence. Ibid., 22.
- Suite de l'histoire de l'anévrisme de l'artère brachiale. Ibid.
- Nouvelles. L'extirpation entière de la matrice. Ibid., 80.
- Plaies pénétrantes du thorax. Ibid., 82-83.
- Amputation de la mâchoire. Ibid., 109.

- Tumeur blanche du genou; amputation de la cuisse. Ibid., 114.
- Fongus hématode en kyste du sein; extirpation. Ibid., 122.
- Kyste osseux développées dans l'épaisseur des os. Kyste à parois osseuses et contenant un tumeur fibreuse. Ibid., 133-134.
- Nécrose d'une moitié du maxillaire inférieur; extraction du séquestre. Ibid., 142-143.
- Destruction de la partie inférieure et antérieure de la joue droite et de la moitié correspondant du corps de la mâchoire suite d'une pustule maligne. Ibid., 165-166.
- Hydrocèle enkystée du cordon. Ibid., 201.
- Taille bilatérale; nouveau lithotome. Ibid., 206.
- Tumeur carcinomateuse par récidence. Ibid., 216.
- Maladies de l'articulation scapulo-humérale-réthrite chronique chez la femme. Fistules lacrymale. Ibid., 225-226.
- Tumeur carcinomateuse née de la face interne de l'apophyse montante. Ablation. Ibid., 238.
- Hernie inguinale congénitale, ou plutôt bubonocèle vaginale avec étranglement à l'orifice supérieur du canal. Ibid., 245.
- Récidive d'un calcul vésical; taille bilatérale pratiquée pour la deuxième fois chez un enfant de 3 ans. Ibid., 252.
- Tumeur érectile dans la cavité oculaire; exophthalmie; extirpation du globe d'o'œil. Ibid., 250; 268.
- Chute en avant sur le paume de la main droite, et sur la pousse de la main gauche; fracture du radius à droite; luxation du pousse sur l'os métacarpe de gauche. Ibid., 286-287.
- Destruction d'une cicatrice vicieuse. Ibid., 295.
- Emphysème des paupières. Ibid., 308.
- Tumeur carcinomateuse du maxillaire supérieur. Ibid., 325.
- Jusqu'à quelle époque est-il possible d'opérer la réduction des luxations, par M. Marr. O., 7: 52-113.
- Observations sur un cas de guérison d'anus contre nature, par l'emploi de la méthode de traitement de M. le professeur Dupuytren, par M. Ballemond. Ibid., 133-142.
- Anévrisme variqueux. Anévrismes variqueux de l'artère et de la veine axillaire, produit par une plaie d'arme à feu. Ibid., 104-109.

Blessure du coeur par un fragment de côte, par M. Marx. Ibid., 247-252.

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Taille bilatérale pratiquée a l'hôtel-Dieu. Reported by P. Ménière. B., 22: 201-215.

Fracture de l'extrémité inférieure de l'humérus. E., 2: 9-10.

Hernie crurale étranglée et anus contre nature. Ibid., 77.

Leçons cliniques sur les brûlures. Ibid., 83-85.

Causes de la mort à la suite de brûlures. Ibid., 89-90.

Carie vertébrale avec fistule et abcès à la région crurale. Ibid., 115-116.

Extraction d'un corps étranger dans le genou. Extirpation d'un oeil carcinomateux. Ibid., 117.

Hydrocèle double du même côté. Deux développée dans un kyste osseux de l'apophyse palatine de l'os maxillaire supérieur. Ibid., 132-133.

Extirpation d'un polype carcinomateux du sinus maxillaire gauche. Ibid., 138-139.

Appendice aux brûlures. Ibid., 139-140.

Fracture du fémur non consolidée. Ibid., 148.

Polypes dans le conduit auditif externe. Ibid., 148.

Trachéotomie. Ibid., 164.

Extirpation d'une tumeur lipomateuse sur le trajet de l'anneau crural. Ibid., 165.

Kyste sereux développé dans le tissu cellulaire qui joint le rectum au vagin—son ablation. Ibid., 165-166.

Kyste à parois osseuses pris pour un polype fibro-celluleux; son extraction. Ibid., 174; 179.

Extraction d'un séquestre du tibia. Ibid., 180.

Extirpation de la matrice. Ibid., 196.

Aortite. Ibid., 208.

Compte rendus de la clinique de M. le professeur Dupuytren, etc. Ibid., 222.

De la réunion médiate et immédiate des plaies d'amputation de membres. Ibid., 274.

Causes des varices. Traitement. Ibid., 321-322.

Revue des journaux de médecine. Clinique chirurgicale de M. Dupuytren pour le mois de Mai 1830. Ibid., 3: 48.

Inflammation de la rétine. Contusion de l'oeil par suite d'un coup de fouet. Amaurose—considérations sur les commotions de la rétine. Quelques faits singuliers survenus à la suite de coups de fouets appliqués sur l'oeil et autres parties du corps. Tumeur érectile naissant du fond de la cavité orbitaire. Extirpation de la tumeur et du globe de l'oeil. H., 6: 71-80.

Réunion immédiate des plaies à la suite des amputation. Correspondance. Ibid., 7: 27-32.

Luxation de l'extrémité supérieure de l'humérus. Luxation congénitale de l'extrémité supérieure du radius sur l'humérus à droite et à gauche. Du délire nerveux, suite de lésions chirurgicales ou d'opérations. Corps étranger dans la trachée—artère (haricot). Trachéotomie. Corps étrangers à l'extrémité supérieure du larynx. Considérations pratiques sur quelques précautions à prendre pour l'opération de la cataracte. Ibid., 44-52.

De la chorée. Traitement employé par M. Dupuytren contre cette maladie. Ibid., 421-432.

Des varices des membres inférieurs. Inflammation d'un ancien sac hernière. Kyste osseux de la voûte palatine. Eruption difficile de la dernière grosse molaire. Ibid., 486-494.

Restauration du visage. Ibid., 8: 84.

Considérations pratiques, 1° sur les abcès par congestion dépendants de la carie de la colonne vertébrale, et sur le traitement à employer contre eux quand celle-ci est guérie 2° sur les abcès vénériens. Corps étranger (pièce de cinq francs) arrêté dans l'oesophage. De la procidence de la membrane muqueuse du rectum. Ibid., 421-429.

Varices artérielles. Ibid., 491.

Hernie inguinale vaginale étranglée; opération. Mort 40 heures après. L., 2: 353.

Calcul vésical; opération extraordinaire pratiquée en ville; succès inespéré. Ibid., 373.

Brûlures; leurs différents degrés, idées du professeur sur cette matière. *Ibid.*, 377.

Fait M. Dupuytren à Académie des sciences. (Rapport verbal.) *Ibid.*, 378.

Leçon sur la combustion dite spontanée. *Ibid.*, 385.

Fongus développé dans le tissu d'une cicatrice; amputation du bras; mort. *Ibid.*, 390.

Etranglement interne, opération par M. M. Dupuytren et Récamier. *Ibid.*, 398.

Extraction d'un polype carcinomateux du sinus maxillaire gauche. *Ibid.*, 3: 37.

Osteo-sarcome des fosses nasales. *Ibid.*, 70.

Amputation de la verge pour cause de cancer. *Ibid.*, 70.

Pommade by M. Dupuytren pour les douleurs vives au col de la vessie et rectum. *Ibid.*, 92.

Taille recto-vésicale. Calculé mural revêtu d'une couche épaisse d'une autre nature, et d'un volume considérable. *Ibid.*, 101-102.

Autopsie du malade opéré de la taille-réflexions. *Ibid.*, 110.

Calcul. *Ibid.*, 112.

Excision de bourrelets hémorroïdaux. Calcul urétral. Catarrhe vésical. *Ibid.*, 127.

Lithotrite. Taille bilatérale. *Ibid.*, 178.

Hernie ombilicale énorme. *Ibid.*, 182.

Taille bilatérale chez un enfant de deux ans. *Ibid.*, 188.

Plaie du coeur produite par un fragment de côte. Déchirure de la rate, mort prompte. *Ibid.*, 188.

Lithotrite. Mort. *Ibid.*, 197; 202.

Hernie et hydrocèle congénitales, traités par la méthode de M. Belmas. *Ibid.*, 248.

Lithotrite sur un enfant de cinq ans. *Ibid.*, 252.

Leçons sur les plaies par armes à feu. *Ibid.*, 319; 325; 328; 332; 339; 344; 347; 352; 356; 360; 372; 375; 385; 387; 396; 4; 3; 16; 19; 36; 52; 64; 85; 87; 111; 139; 159.

Oblitération complète de l'orifice du vagin, etc. *Ibid.*, 4: 40.

Occlusion congénitale du vagin; incision de la membrane. *Ibid.*, 48.

Tumeur fibro-celluleuse naissant du côté gauche du corps thyroïde, et du volume de la tête, chez un enfant de douze ans, etc. *Ibid.*, 95.

1831

Rapport verbal de M. Dupuytren, sur l'ouvrage de Diffenbach, intitulé: De la restitution et de la réparation des organes enlevés. Berlin, 1831. *J.*, 5: 177-179.

Du rapport de la forme des plaies avec celle des armes ou instruments qui les ont déterminées. *Ibid.*, 301-306.

De la rétraction des doigts par suite d'une affection de l'aponévrose palmaire. Description de la maladie. Opération chirurgicale qui convient dans ce cas. *Ibid.*, 352-365. Also, rev.: *Gaz. méd. de Paris*, 3: 41, 1832. Also, transl.: *London M. and S. J.*, 1: 266-268, 1832. Also, transl.: *K.*, 2: 222-225, 1833-1834. Also, in *Leçons orales de clinique chirurgicale*. 6: 473-502, 1839.

Remarques et observations sur les plaies du coeur. *J.*, 5: 373-385.

Encysted tumour of the breast mistaken for scirrhus. *L.*, 4. Also, abstr.: *K.*, 2: 236, 1831.

Imperforation de l'anus. Inflammation suspecte de la joue. *L.*, 4: 215.

Facétie morale de M. Dupuytren. *Ibid.*, 226.

La première victime de la doctrine déplorable, ligature de l'artère fémorale. *Ibid.*, 231.

Taille sur pubienne; opération laborieuse. *Ibid.*, 244.

Fausse articulation suite de fracture non consolidée de l'humérus; résection des parties osseuses. *Ibid.*, 291.

Étranglement interne incomplet. *Ibid.*, 316.

Partie de substance considérable à la face, causée par un coup de pistolet; etc. *Ibid.*, 323.

Blessure de l'artère tibiale postérieure; anévrisme faux primitif, etc. *Ibid.*, 327; 359.

Rétention d'urine guérie par la vue d'un moxa. *Ibid.*, 347.

Transes nerveuses; traitement par les bains froids. Amputation du col de l'utérus. *Ibid.*, 347.



Bec de lièvre simple avec divisions des os du palais, du voile et de la luette, insuccès d'une première opération: deuxième opération. Ibid., 356.

Calculs du périnée, de l'urètre, de la vessie, lithotrite. Ibid., 5: 5.

Calcul vésical (etc.). Ibid., 17.

Lipome contenant un noyau osseux considérable à son centre. Ibid., 66.

Fracture du crâne, avec enfoncement produite par un coup de boule sur la tête. Mort. Épanchement considérable de sang dans le cerveau. Ibid., 73.

Fracture de jambe avec délire (etc.). Ibid., 73.

Lettres et attestations adressés à M. Boulland, par six juges du concours pour la Chaire de Physiologie. Ibid., 76.

Lipome du poids d'une livre sur l'épaule gauche d'une femme; extirpation. Ibid., 81.

Séquestres du fémur; emploi de la pince à trois branches avec foret exfoliatif. Ibid., 81.

Hydrocèle double volumineuse opérée le même jour par ponction et injection. Ibid., 82.

Tumeurs de diverse nature au col. Ibid., 82.

Tumeur cancéreuse du sein; partiellement envahie par gangrène; observation analogue faite remarquable. Ibid., 94.

Amaigrissement général; ascite; mort; cirrhose du foie; exostoses volumineuses développées sur la plupart des os. Ibid.

Kystes séreux développés au cou entre l'os et le cartilage thyroïde. Ibid., 101.

Blessure de l'artère radiale au poignet, par suite de l'explosion d'une pistolet; ligature des deux bouts du vaisseau. Ibid., 109.

Fistule anale incomplète. Ibid., 110.

Hydrocèle de peu de volume chez un enfant de six ans; opération par incision. Squirrhe considérable du sein; gangrène de la totalité de la tumeur; guérison du squirrhe. Ibid., 110.

Tumeur cancéreuse du sein, partiellement envahie par la gangrène. Ibid., 122.

Cataracte chez un jeune homme, broyement avec l'aiguille à crochet de Scarpa. Tumeur de nature douteuse à la tempe, traitement mercuriale, rhumatisme au genou, érysipèle, pneumonie, disparation complète de la tumeur, retour et progrès du mal après la guérison des maladies incidentes. Ibid., 129.

Phlegmon à la partie supérieure, antérieure et interne de la cuisse (etc.). Ibid., 133.

Abcès à la marge de l'anus; considérations générales; multiplicité des orifices fistuleux internes. Ibid., 141.

Coup de fusil chargé à bourre; plaie à la region iliaque avec dénudation du péritoine et de l'os des iles (etc.). Ibid., 147.

Tentatives de suicide; coups de poinçon dans la région du coeur ayant produit des blessures analogues à des coups de canif. Ibid., 157.

Polype fibreux du col de l'utérus. Ibid., 161.

Hameçon implanté dans l'avant-bras. Ibid., 238.

Fracture avec issue de l'os, à la partie inférieure de l'humérus dans l'union du corps avec l'épiphyse, chez un enfant de 15 ans. Ibid., 239.

Fracture des deux clavicules. Ibid., 239.

Kyste à parois osseuses dans mâchoire inférieure. Ibid., 239.

Tumeur au col avec battement. Ibid., 239.

Hernie crurale volumineuse, étranglée. Ibid., 239.

Cicatrices, suites de brûlure, à paume de la main, à la face palmaire des doigts—et de l'avant bras (etc.). Ibid., 249.

Fistule aérienne et alimentaire. Ibid., 249.

Nécrose de l'os maxillaire inférieur avec plusieurs ouvertures; fistules dans la bouche. Ibid., 249.

Trois opérations de cataracte. Ibid., 265.

Tumeur blanche du coude. Ibid., 266.

Fracture de la mâchoire inférieure; déchirure des parties molles dans la bouche; abcès à la région inférieure du cou; passage de pépins de raisin de la bouche dans le foyer. Ibid., 266.

Rétrécissement urétral; catarrhe de vessie; calcul vésical; taille latérale sans qu'on ait trouvé la pierre; fistule urétrale;

essai infructueux de l'instrument de Jacobson; taille bilatérale à l'hôtel-Dieu; extraction d'un calcul volumineux très friable. Ibid., 285; 290.

Carie vertébrale; abcès sympathiques; ouverture spontanée. Ibid., 297.

Suppression d'un écoulement blennorrhagique; engorgement consécutif du testicule; considérations générales sur la nature et le traitement de cette maladie. Ibid., 305.

Fistule laryngo-pharyngienne à la suite d'une blessure au cou. Ibid., 304.

Fracture transversale de la rotule, traitée par la position et le bandage unissant (appareil de M. Dupuytren). Ibid., 313.

Fistule laryngo-pharyngienne; chute des aiguillés masses le troisième jour de l'opération. Ibid., 314.

Chute du rectum habituelle chez un enfant de trois ans; excision de trois plis rayonnés de l'anus. Ibid., 319.

Quelques cas de fracture (etc.). Ibid., 321.

Atrophie ancienne du bras droit; fracture à l'humérus de ce côté; consolidation complète. Chute sur le morgnon de l'épaule, fracture sans déplacement à la partie supérieure de l'humérus. Chute sur le front dans un état d'ivresse; plaie avec issue d'un des os propres du nez; extraction de cet os. Ibid., 352-326.

Méthode endermique; application de l'hydrochlorate de morphine. Emphysème des paupières et de la joue à la suite d'une chute sous un éboulement du terre. Ibid., 330-331.

Contracture permanente des doigts avec mobilité de chaque articulation et impossibilité de l'extension; applications nouvelles par la cause et le siège de cette maladie. Ibid., 341-343.

Engorgement scrofuleux du testicule; considérations générales sur la nature et le traitement de cette maladie. Ibid., 346.

Engorgement vénérien du testicule; carie vertébrale; abcès symptomatique. Ibid., 357-358.

Hydro-sarcocèle compliqué de hernie congénitale; communication libre entre le tunique vaginale et l'abdomen permettant à l'une partie de la tumeur de rentrer et de sortir;

occlusion de cette ouverture par l'épididyme de manière à ce, que le liquide ne pouvait rentrer. Ibid., 373.

Parties utérines; providence considérable de la lèvre droite du museau de tanche et de cette partie du col de la matrice, enfoncement digitiforme à l'extrémité. Contenant un polype muqueux; deux autres polypes muqueux au-dessus: excision, hémorragie, tamponnement, abcès développé entre la paroi postérieure du pharynx et la colonne cervicale. Ibid., 374.

## 1832

Leçons orales de clinique chirurgicale, faites à l'hôtel-Dieu de Paris. Paris, Germer-Baillière, 1832-1834. 8°, 4 v. (same) Vortrage über chirurgische klinik in hôtel-Dieu in Paris gehalten. Bon einer Gessellschaft von Aerzten brsg. und aus dem Franzosischen übersetzt von G. Weyland. Paris, Heideloff u. Compe, 1832-1833. 8°, 2 pts. in 1 v. xvi, 182 pp., 1 l.; 232 pp., 1 pl.

(same) Clinical lectures in surgery. Translated from the French by A. S. Doane. Philadelphia, De Silver, Jr. and Thomas, 1833. 8°, viii, 9-312 pp.

(same) Boston, Carter, Hendee and Co., 1833. 8°, iv, 312 pp.

(same) Für Deutschland bearbeitet von Emil Bech und Rudolph Leonardi. Leipzig, Baumgartner, 1834. 8°, 2 v. xvi, 579 (1 l.) xii, 250 pp.; 297 pp., 1 l., 4 pl., port.

(same) Lezioni vocali di clinica chirurgica dette nell'hôtel-Dieu di Parigi, raccolte e pubblicate da una societa di medici. Volume unico. Firenze, S. Coen, 1834. 8°, 670 pp.

(same) Clinical lectures on surgery. Translated from the French by A. S. Doane. Washington, Duff Green, 1835.

(same) Recueillies par Brierre de Boismont et Marx. 2 ed. entièrement refondue. Paris, Germer-Baillière, 1839. 8°, 6 v.

Lettre et leçon sur le siège, la nature et la traitement du cholera morbus. Recueillies et publiées par MM. A. Paillard et Marx. Paris, J.-B. Baillière. 8°, 31 pp.

- Fascicule d'observations sur la rétraction des doigts. J., 6: 67-75.
- Étranglements des hernies par le collet du cas herniaire. Ibid., 8: 97-145.
- Rapport verbal sur l'histoire médicale de l'armée d'orient, par M. le Baron Desgenettes. Ibid., 368-371.
- Notice sur un cas de fungus de l'oeil. Ibid., 385-394.
- Fracture des os par l'action musculaire. Ibid., 446-450.
- Leçons sur les étranglements des hernies par le collet du sac herniaire. Ibid., 9. Also: Paris, J.-B. Baillière. 8°, 51 pp.
- Tissue of the anus treated by Dupuytren. Note. K., 1: 838.
- Affection rhumatismale des muscles du col, simulant une luxation de vertèbres. L., 5: 378.
- Distension et engorgement des ligaments intervertébrale de la colonne cervicale. Ibid., 379.
- Fractures du col des fémurs. Ibid., 381.
- Sourd-muet de naissance; perforation de la membrane du tympan. Ibid., 386.
- Blenorrhagie très ancienne; abcès urinaire, trajet fistuleux de dégénéré en carcinome. Ibid., 386.
- Appareil pour les fractures du col des fémurs. Ibid., 398.
- Des fractures de l'extrémité inférieure du péroné. Ibid., 401; 406; 412; 421.
- Fracture par cause direct et sans déplacement de la partie supérieure du tibia. Contusion chez un ivrogne; Fractures du col du fémur. Ibid., 433; 441.
- Hydro-sarcocèle: Cancer du sein. Ibid., 453.
- Anévrisme faux consécutif survenu à la suite d'une saignée. Ibid., 476.
- Hernie inguinale droite étranglée, formation d'un abcès dans l'épaisseur des parois abdominales de la fosse iliaque du même côté. Ibid., 6: 2.
- Fractures de l'extrémité inférieure du radius. Ibid., 14.
- Coup de pied de cheval dans la région temporale gauche; partie subite de connaissance qui cesse au bout de cinq jours: idiotisme: difficulté d'élocution: très faible paralysie du côté

- droit; large excavation de l'endroit où à été reçu le coup, produite par la dépression des os de cette région. Ibid., 26.
- Coup de feu à la partie supérieure de la poitrine; fracture de la clavicule; balle libre dans la cavité de la poitrine et reposant sur la diaphragme (Observation par M. Dupuytren). Ibid., 34.
- Hernie crurale gauche étranglée par le collet du sac; fausse réduction par le taxis; application d'un bandage; persistance des accidents; administration de purgatifs; abcès stercoral; anus contre nature; guérison. Par Cazeaux, interne. Ibid., 38-39.
- Tumeurs fibro-celluleuses, sous-cutanées, de peu de volume et susceptible de dégénérer; considérations générales. Ibid., 40.
- Cholera morbus, traitement. Ibid., 51.
- Nouveau traitement adopté par Dupuytren. Ibid., 63.
- Leçon sur les plaies par armes à feu. Fracture de l'olécrane, ouverture de l'articulation. Ibid., 194; 201-202.
- Tumeur au cou de nature douteuse; chute dans un puits; chute d'un lieu élevé sur le sol. Tumeurs blanches au gros orteil: Tumeur au nez et ulcération (etc.); Blessure à la cuisse. Ibid., 249-250.
- Rétrécissement diaphragmatique du rectum (etc.). Ibid., 301.
- Ulcère syphilitique à la lèvre avec bubon sous-maxillaire, communiqué par un baiser. Ibid., 302.
- Polype de o'oreille (etc.). Ibid., 302.
- Diagnostic différentiel des luxations et des fractures du col de l'humérus (etc.). Ibid., 309-310.
- Calcul vésical d'un gros volume chez un enfant de neuf ans. Ibid., 381.
- Bec-de-lièvre double. Ibid., 381.
- Fracture des os de l'avant-bras, accidents consécutifs graves produits par un appareil trop serré. Ibid., 410.
- Accouchement laborieux, enclavement de la tête (etc.). Ibid., 417-418.
- Castration opérée à deux reprises, par jalousie et avec violence. Ibid., 421.

- Amputation de l'avant bras dans l'articulation. Ibid., 421.
- Ablation des testicules et de la verge pratiquée par la malade lui-même. Ibid., 432.
- Rupture présumée de la vessie. Rupture de la vessie par lésion extérieure. Ibid., 441.
- Érysipèle phlegmoneux des téguments du crâne. Par Aussaudon. Ibid.
- Taille pratiquée sur deux enfants du même âge. Par Aussaudon. Ibid., 455.
- Angine oedémateuse suffocante. Ibid., 457.
- Brûlure de toute la cuisse au 4<sup>e</sup> degré. Bec-de-lièvre double. Ibid., 466.
- Amaurose vénérienne sympathique. Ibid., 474.
- Fracture comminutive de la cuisse. Ibid., 475.
- Suicide; coup de pistolet tiré au front, balle logée dans le corps même du sphénoïde. Ibid., 481.
- Cancer de l'épigastre. Ibid., 481.
- Luxation fémorale double en bas et en avant. Ibid., 490.
- Paraphymosis chez un enfant. Ibid., 491.
- Surdité par obstruction mécanique du conduit auditif externe. Ibid., 491.
- Hydrocèle opérée en ville par injection. Ibid., 493.
- Tumeur du volume d'un oeuf de poule développée par accumulation lymphatique. Ibid., 503.
- Lipome du poids de 17 onces, développée à la partie postérieure du col. Ibid., 504.
- Écrasement de l'extrémité inférieure du péroné et des os du tarse. Ibid., 510.
- Asphyxie; brûlure au 4<sup>e</sup> degré. Ibid., 515.
- Brûlure au 4<sup>e</sup> et 5<sup>e</sup> degré de toute la surface du corps. Ibid., 515.
- Fracture du péroné, compression du plexus brachial par emploi d'une béquille. Tumeur nerveuse. Ibid., 521.
- Tumeur érectile accidentelle du volume d'une grosse noisette, développée à la partie antérieure et latérale droite du coude. Ibid., 18.
- Rétraction de l'aponévrose palmaire. Ibid., 18.

- Tumeur enkystée du volume d'un petit oeuf de poule, développée dans tissu de la langue. Ibid., 22.
- Maladies des articulation. Ibid., 23.
- Fracture du bras sans violence extérieure, et produite par le seul effet de la contraction musculaire. Ibid., 29.
- Onglade proprement dite. Ibid., 38.
- Polype utérin du volume d'une pomme. Ibid., 46.
- Fracture comminutive des os de l'avant bras; amputation. Ibid., 58.
- Chute d'une hauteur de 25 pieds; fracture de la colonne vertébrale au niveau des onzième et douzième vertèbres dorsales. Ibid., 63.
- Affection nerveuse accidentelle (danse de Saint-Guy). Ibid., 71.
- Empoisonnement volontaire par l'acide sulfurique. With Husson. Ibid., 74.
- Accouchement à terme d'un enfant mort; suppression accidentelle des lochies; abcès volumineux développés à la partie antérieure et supérieure de la jambe. Ibid., 530.
- Phlegmon érysipélateux des teguments du crâne. Ibid., 535.
- Catarrhe vésical aigu chez une femme. Ibid., 537.

## 1833

- Observation sur une restauration du nez. J., 12: 29-40.
- Kystes hydatiques. Ibid., 97-129.
- Luxation de l'astragale. Ibid., 13: 189-200; 473-483.
- Spina-ventosa à la deuxième phalange de l'indicateur de la main gauche. Ibid., 446-451.
- Chute de 40 pieds de hauteur, la mâchoire inférieure ayant rencontré l'extrémité aiguë d'une grille, s'y est enferrée, et la malade est resté ainsi suspendu pendant plusieurs secondes. Fracture du maxillaire inférieure. Asphyxie mécanique. L., 7: 6.
- Vérole constitutionnelle caractérisée par un énorme bubon, des ulcérations, des excroissances syphilitiques, hernie inguinale et affection de la peau (gale chez le même sujet). Ibid., 10.



- Fracture par contre-coup du quatrième os du metacarpe de la main gauche. Ibid., 75.
- Coup du pied du cheval. Ibid., 78.
- Fracture comminutive de la jambe. Ibid., 87.
- Luxation spontanée du fémur. Ibid., 95.
- Goitre double du volume des deux poings. Ibid., 118.
- Fracture de la colonne vertébrale. Ibid., 119.
- Occlusion complète du vagin. Ibid., 123.
- Inflammation phlegmoneuse, large anthrax développée à la région lombaire gauche. Ibid., 137.
- Monomanie furieuse, suicide par des coups de rasoir. Ibid., 142.
- Anus contre-nature. Ibid., 169.
- Anus contre-nature accidentel par suite de la ligature de cordon ombilical au moment de la naissance. Ibid., 170.
- Encéphalocèle, par suite vice de conformation de la face. Ibid., 179.
- Affection mortelle très vive, plaie de tête par arme à feu, enlèvement de destruction de la paroi externe des sinus frontaux; hépatite. Ibid., 190.
- Ophthalmie syphilitique aiguë; sortie du cristallin, cécité. Ibid., 203.
- Tissu érectile pur, tumeur développée au côté gauche et la face interne de la lèvre inférieure. Ibid., 210.
- Hernie ventrale congénitale développée à travers un écartement des fibres du grand et oblique. Ibid., 222.
- Ramollissement de tout le système osseux par suite de fracture pendant la vie de plusieurs membres. With Husson. Ibid., 234.
- Violente contusion de l'hypocondre droit; large déchirure du foie, par la chute d'un pain de munition. Ibid., 254.
- Développement d'hydatide dans le corps de l'humérus: fracture de cet os, articulation contre nature. Ibid., 256.
- Kyste séreux né dans la cavité de l'orbite droit; ophthalmie considérable. Ibid., 290.
- Hernie inguinale congénitale du côté gauche. Ibid., 314.
- Préparation arsenicale de M. Dupuytren pour le traitement des ulcères rongeurs. Ibid., 315.

Violent coup de pied de cheval dilacération de toute la face dorsale de la main droite; disarticulation de l'auriculaire.

Ibid., 326.

Plaie par déchirure; anévrisme faux consécutif, hémorragies.

Ibid., 327.

Kyste stéatomateux développée dans l'épaisseur du prépuce.

Ibid., 328.

Carie de l'articulation scapulo-humérale. Ibid., 348.

Tumeur graisseuse extérieure au péritoine compliquée de hernie crurale. Ibid., 372.

Apoplexie séreuse des auteurs; fracture comminutive de la jambe.

Ibid., 373.

Lésion de l'artère radiale par un coup de serpette; abondant et membrané hémorragie. Ibid., 390.

Vice de conformation des os propres de nez; par suite, tumeur, fistule lacrymale; rétablissement du canal urétral à l'aide d'un vilebrequin. Ibid.

Catarrhe chronique vésical survenu à la suite d'une maladie de la poitrine. Ibid., 329.

Atrophie des branches antérieure, de la moelle épinière, paralysie générale du mouvement. Ibid., 339.

Affection du cœur rétrécissement de l'ouverture auriculo-ventriculaire gauche; aspect gangreneux de toutes les extrémités saillantes du corps, le nez, les oreilles, les mains, les pieds, etc. Ibid., 347.

Affection calculeuse chez une jeune femme; taille urétro-vésicale. Ibid., 363.

Chute sur la tête: érysipèle phlegmoneux des téguments du crâne. Ibid., 376.

Affection cancéreuse développée à la jambe gauche. Ibid., 402.

Quelques accidents produits par l'ivresse; verge coupée par une fenêtre à guillotine; fracture du col du fémur; chute dans un escalier; luxation latérale de l'astragale en avant et en dehors sans plaies à la peau. Ibid., 423.

Congélation des extrémités inférieures; chagrin domestique; suicide: large plaie à la partie antérieure du cou. Ibid., 420.

1834

Traité théorique et pratique des blessures par armes de guerre.  
Rédigé—et publié sous sa direction par A. Paillard et Marx.  
Paris, J.-B. Baillière. 8°, 2 v., xlv, 522, 527 pp.

(same) Theoretisch-praktische vorlesungen über die Ver-  
letzungen durch kriegesmaffen, unter Mitinirkung des—  
C. F. von Graefe, aus dem Franzosischen bearbeitet von M.  
Kalish. Berlin, Veit u. Comp., 1836. 8°, vxi, 1 l., 630 pp.  
Also, under title: Vollständiges lehrbuch über die Ver-  
wundungen, mit besonderer Rucksicht auf Militairchirurgie,  
nach Dupuytren's vorlesungen, under Mitunirkung des...  
etc.

Kyste hydatique (Dupuytren) en bissac à la partie postérieure  
externe de l'articulation tibia-tarsienne. L., 8: 26.

Ulcère syphilitique développé à la lèvre supérieure; et simulant  
une pustule maligne; entorse; érysipèle double développé à  
face; fracture oblique du tibia. Ibid., 199.

Plaie par arme à feu. Ibid., 200.

Violente contusion à la face; par suite nécrose de l'os malaire;  
fistule. Ibid., 223.

Fracture par cause direct de l'extrémité externe de la clavicule.  
Ibid., 223.

Affection calculeuse chez un enfant de cinq ans: taille sur le  
raphé; extraction d'une pierre du volume d'une noisette.  
Ibid., 251.

Corps étranges arrêté dans l'oesophage (etc.). Ibid., 255.

Hernie ombilicale (etc.). Ibid., 274.

Hernie inguinale double (etc.). Ibid., 275.

Ivresse; coup de poing dans un carreau; lésion de l'artère radiale;  
abondante hemorrhagie; ligature des deux bouts du vaisseau  
divisé; méthode sûre et exacte de l'appliquer. Ibid., 298.

Hernie crurale, entéro-epiplocèle chez un homme, symptômes  
graves d'étranglement (etc.). Ibid., 301.

Leçons sur l'incarnation de l'ongle et l'inflammation de sa matrice.  
Ibid., 310.

Maladie des voies urinaires; violente contusion au périnée;

déchirure du canal de l'urètre, hématurie abondante (etc.).  
Ibid., 334.

Large tumeur carcinomateuse développée aux dépens des muscles  
de la poitrine (etc.). Ibid., 342.

Chorée produite par une frayeur (etc.). Ibid., 354.

Paralysie du pied chez une femme; par suite d'une contusion des  
nerfs intra-pelviens (etc.). Ibid., 358.

Luxation originelle ou congénitale de la tête des fémurs. Ibid.,  
362; 367.

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## INTRODUCTION

Guillaume Dupuytren is considered the founder of clinical surgery in the famous French School of the early nineteenth century. By Garrison he is called "the ablest and best trained French surgeon . . . at once a shrewd diagnostician, an operator of unrivaled aplomb, a wonderful clinical teacher and a good experimental physiologist and pathologist."

In his early life Dupuytren had a serious struggle against poverty, a condition which influenced his character in later life. He early learned the value of hard work and at the age of seventeen was appointed prosecutor at the École de Médecine in Paris. He advanced himself rapidly by his own efforts and when twenty-seven years old, he became associated with the Hôtel Dieu. Ten years later he was appointed chief surgeon at that famous hospital of 1000 beds. There were five surgical wards of 264 beds of which Dupuytren kept 113 for his own service and in the single year of 1829, 1400 cases were treated there. It is estimated that he saw about 10,000 patients annually outside of his hospital work.

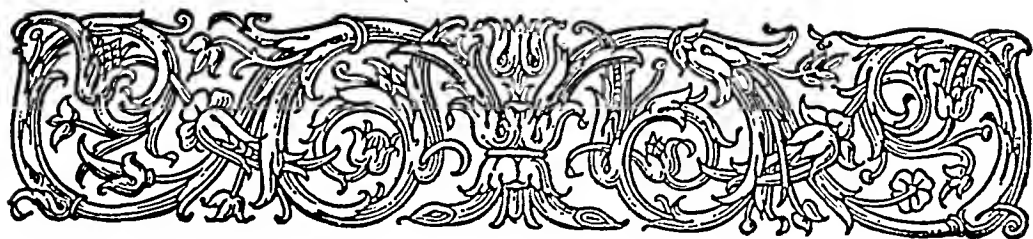
For nineteen years after his elevation to the position of chief surgeon at the Hôtel Dieu, that is, until he was forced to retire from practice by ill health, Dupuytren led a very strenuous existence. He rose daily at five o'clock and made rounds at the hospital from six until nine. At that hour he delivered a clinical lecture to a large crowd of students and visiting doctors from all countries. In these lectures he covered practically all of the important subjects of surgery. A great many of the lectures were written down by his pupils and later published. Here we find a great generosity of Dupuytren; many of the lectures were published under the name of the student who had transcribed the notes. In his busy life Dupuytren had little time to read and less time to write; he found his own surgical ideas quite sufficient. After the morning lecture Dupuytren performed several operations, in the afternoon he devoted himself to his private office practice and returned to the hospital for further rounds in the early evening. It is said that rarely was a post mortem examination made without his presence.

A list of Dupuytren's surgical accomplishments would cover practically all phases of surgery as it was practiced in his day. Garrison credits him as being the first to excise the lower jaw (1812) and to treat aneurism successfully by compression (1818), the first to treat wryneck by subcutaneous section of the sternomastoid muscle (1822), a successful ligation of the external iliac artery (1818) and two ligations of the subclavian (1819-29). He devised an original method of treating artificial anus by an instrument of his own invention (1828), wrote an original description of fracture of the lower end of the fibula (1819) and congenital dislocation of the hip joint (1826). He described fractures of

children (1811), vaginitis in maidens (1827), varicose aneurisms (1829), subluxation of the wrist afterwards known as Madelung's deformity. His works *On injuries and diseases of the bones* and *Clinical lectures* were reprinted and translated several times.

Dupuytren's name is today used, more than in any other way, to designate a contracture of the fingers from an affection of the palmar aponeurosis. Of this condition he gives a clear description and for it devised an operation in 1832. The original French and a later English translation are included in this number of Medical Classics. Also republished here is an English translation of Dupuytren's work on fracture of the distal end of the fibula which is frequently given the name of Dupuytren's fracture. This condition had early been described by Percival Pott. See Medical Classics, Volume I, No. 4. Dupuytren, however, gave a more detailed account of the fracture and covered every phase of the problem in a thorough manner.

In his work on contracture of the fingers, Dupuytren stated that he was unable to give any definite cause for the condition. He did recognize that the affection occurred especially in men who used the hands over a long period of time in grasping and in heavy manual labor. In modern times, even the great work of Kanavel, Koch and Mason of Chicago on this contracture does not contain any more definite idea as to causation than Dupuytren himself was able to give. These modern workers, who spent many years in a special study of hand affections, found it necessary to refer back to the famous work of Dupuytren for the source of their earliest knowledge. With modern anesthesia and asepsis the operative treatment has been greatly improved but to Dupuytren we owe a great debt for our early knowledge of this special deformity of the hand. It is fitting that the work of the founder of clinical surgery of the French School should be included in Medical Classics.



# De la R'traction des Doigts par suite d'une Affection de l'Apo-névrose Palmaire. Description de la Maladie. Opération Chirurgicale qui Convient dans de Cas

De la Clinique Chirurgicale de l'Hôtel-Dieu

M. DUPUYTREN

Par MM. les Docteurs Alexandre Paillard et Marx

*Journal universel et hebdomadaire de médecine et de chirurgie pratiques et des institutions médicales. Paris. 2 s., 5: 352-365. 1831*

**N**OUS donnons ici, avec détail, la leçon de clinique chirurgicale de M. Dupuytren, faite le 5 décembre 1831. Cette leçon est un véritable Mémoire sur un sujet entièrement neuf, et dans lequel se trouvent exposées une théorie et une méthode de traitement nouvelles contre une maladie généralement regardée comme incurable.

(p. 349) Nous allons nous efforcer de rapporter textuellement les paroles du professeur, ne fût-ce que pour donner une idée de sa manière:

“Je ne vous parlerai aujourd'hui que d'un seul malade et d'une seule maladie. Le malade qui est soumis à votre observation est le nommé Demarteau (Jean Joseph), âgé d'en-

viron 40 ans, exerçant la profession de cocher de fiacre; il est couché au n° 63 de la salle Ste.-Marthe. Sa maladie est une rétraction permanente du doigt annulaire et des doigts voisins à chaque main, survenue spontanément, sans aucune violence et aucune maladie antérieure. Depuis quelques années, il a vu ces doigts seretirer insensiblement vers la paume de la main, et la peau de cette partie former plusieurs plis en arcs de cercle qui s'emboîtent les uns dans les autres et dont la concavité est tournée vers la base des doigts. En redressant les phalanges, on aperçoit une espèce de corde qui se prolonge du doigt à la paume de la main, et dont la tension augmente dans la proportion des efforts que l'on fait pour redresser les doigts affectés. Chez cet homme, la rétraction est portée au point (p. 350) que les doigts font angle droit avec la paume de la main, qu'il est impossible au malade de les redresser lui-même, et qu'aucune puissance appliquée aux doigts ne saurait y réussir sans opérer une déchirure.

Cette espèce de rétraction, tout-à-fait différente de celle qu'on observe si souvent à la suite des inflammations, des plaies, des fractures, etc., etc., est une maladie assez fréquente, car j'ai pu en observer de trente à quarante exemples dans l'espace d'une vingtaine d'années.

Malgré cette fréquence, les causes, la nature et le traitement de cette maladie, sont restés inconnus jusqu'à ce jour; du moins, je les ai vainement cherchés dans les auteurs qui ont écrit sur les maladies de la main. Il est vrai que ma vie, presque toute employée à agir, ne m'a, peut-être, pas permis de faire sur ce sujet, des recherches assez approfondies; loin d'être affligé qu'on pût trouver dans les écrits de ceux qui nous ont précédés, quelques indications de ce que je vais dire, je m'en réjouirai, au contraire, car ces indications seraient une utile confirmation de ce que j'ai observé.

Cette maladie survient sans avoir été précédée d'aucune affection rhumatismale ou goutteuse, d'aucune inflammation des coulisses tendineuses, des capsules synoviales articulaires, sans entorse, sans distension des ligaments, sans ankylose, sans fracture ou violence extérieure quelconque; mais on l'observe

particulièrement chez les personnes qui saisissent souvent avec la main des corps durs, et agissent long-temps avec eux, en prenant un appui sur sa paume. Ainsi, notre malade est cocher de fiacre, obligé, par conséquent, de tenir presque constamment à la main, un fouet à manche gros et dur, de s'en servir sans cesse pour hâter la lenteur de deux mauvais chevaux, et la paume de sa main et la face palmaire de ses doigts, sont ainsi exposées à une pression, et en quelque sorte à une contusion perpétuelles.

(p. 351) J'ai observé cette rétraction chez un marchand de vin qui, obligé par état de déguster souvent des vins, est dans l'habitude de donner, dans le cours de la journée, des coups de poinçon à un grand nombre de pièces; le manche de ce poinçon, gros et dur, contondait fortement la paume de la main.

Je l'ai rencontrée aussi chez un homme de cabinet, qui cachetait journellement beaucoup de lettres en y mettant un soin tout particulier, avec de la cire et un cachet dont le manche arrondi pressait très fortement la paume de sa main. Enfin, je l'ai remarquée chez des maçons et autres personnes obligées de soulever, avec la pointe des doigts, de pesants fardeaux. Dans d'autres cas, je n'ai pu découvrir aucune cause à cette maladie.

Ainsi, dans la majeure partie des cas que nous venons d'indiquer, un corps volumineux et dur a été reçu dans la paume de la main, et a exercé, sur cette partie, des contusions plus ou moins fortes et répétées.

La maladie commence ordinairement par le doigt annulaire; elle s'étend de là aux doigts voisins, et particulièrement au doigt auriculaire; elle augmente par degrés insensibles. Les malades éprouvent d'abord un peu de raideur dans la paume de la main, et de la difficulté à étendre le doigt; bientôt ces doigts restent fléchis au quart, au tiers ou à moitié; la flexion est quelquefois portée beaucoup plus loin, et l'extrémité libre des doigts vient alors s'appliquer à la paume de la main. Dès le principe, une corde se fait sentir sur la face palmaire des doigts et de la main; cette corde est plus tendue quand on fait effort pour redresser les doigts, et elle disparaît presque entièrement quand ils sont tout-à-fait fléchis. Elle est de forme arrondie; sa partie la plus saillante se trouve à la hauteur de l'articulation du doigt avec

le métacarpe qui sert de soutien. Elle forme là une espèce de (p. 352) pont. Ses extrémités se terminent insensiblement du côté du doigt, à la hauteur de la seconde phalange, et du côté de la main, vers le milieu de sa paume, et quelquefois seulement vers sa partie supérieure.

La peau située dans la direction du doigt forme des plicatures en arcs de cercle, dont la concavité est placée en bas, dont la convexité est en haut, et dont le premier emboîte en quelque sorte, la base du doigt, et est lui-même emboîté dans les arcs de cercle plus élevés; ceux-ci diminuent insensiblement, et atteignent ordinairement le milieu de la paume de la main. Ces symptômes se bornent, pendant quelque temps, au doigt primitivement affecté, mais plus tard, ils s'étendent aux doigts voisins, dans lesquels cependant ils sont toujours beaucoup moins prononcés.

Malgré toutes ces apparences d'une lésion profonde, les articulations des doigts affectés ne présentent aucune trace d'ankylose, et, sans excepter celle de la première phalange, elles sont très mobiles dans le sens de la flexion: mais elles ne sauraient être étendues au-delà d'un certain point, quels que soient les efforts que l'on fasse; et, en effet, nous avons vu plus d'une fois que des poids de cent, et même de cent cinquante livres, pouvaient être appendus à l'espèce de crochet que forme le doigt, sans que pour cela son angle de flexion fût ouvert d'une ligne. Il semble que le doigt soit empêché de se redresser par un arc-boutant inflexible, placé dans le sens de l'extension. Il n'y a pourtant d'autre obstacle à ce mouvement, que la corde située sur la face palmaire des doigts et de la main, corde dont la saillie et la tension sont, en général, proportionnées aux efforts tentés pour redresser le doigt.

La maladie commence, se développe et atteint son plus haut degré, sans que les malades éprouvent aucune douleur. Les efforts mêmes dont nous venons de parler n'en causent (p. 353) presque aucune; il semble que la maladie dépende d'un obstacle tout-à-fait mécanique, et que cet obstacle soit formé par des parties qui ne jouissent presque d'aucune des propriétés qui rendent les autres parties sensibles à l'action des violences extérieures.

Quel est le siège, et quelle est la cause de cette singulière affection? Cela est important à déterminer pour asseoir son traitement sur des bases solides.

Quelques personnes ont cru devoir l'attribuer à un épaissement de la peau de la paume de la main. Mais cette enveloppe, obligée qu'elle est d'obéir aux mouvements des doigts, n'est que retirée sur elle-même, par suite de la rétraction de ceux-ci, et elle est donc tout-à-fait étrangère à la maladie. D'autres personnes l'ont attribuée à un état spasmodique, à une contracture du corps des muscles de la face antérieure de l'avant-bras; ce qui n'est pas mieux fondé, car ils jouissent de la plus entière liberté de se contracter et d'obéir à la volonté. D'autres, et c'est le plus grand nombre, ont pensé qu'il y avait une maladie aux tendons des muscles fléchisseurs, un épaissement, une inflammation chronique de ces cordes organisées. J'ai moi-même partagé long-temps cette opinion, et je ne l'ai abandonnée, que lorsque la dissection des parties m'a appris, plus tard, que les tendons indiqués n'offraient aucune espèce d'altération.

On a pu croire que la rétraction des doigts dépendait d'une inflammation chronique des coulisses tendineuses, ou d'un relâchement et d'une destruction des gâines qui les forment, lesquelles cessant de retenir les tendons dans leur coulisse, leur permettaient de faire en avant la saillie que nous avons signalée; mais dans ce cas, il ne devrait y avoir aucun obstacle à ramener ces tendons à leur situation naturelle. Or, l'impossibilité de redresser les doigts étant un des caractères essentiels de la maladie que nous décrivons, il est de toute (p. 354) évidence qu'elle ne dépend pas de cette cause. On a pensé qu'elle tenait à l'altération des surfaces articulaires, à leur déformation, à leur usure, à leur ankylose, ou bien enfin à une disposition des ligaments latéraux qui réunissent ces surfaces. Cette dernière opinion mérite quelque attention. On observe (et il y a très long-temps que j'ai fait cette remarque dans ma Thèse, à la Faculté de médecine de Paris, il y a plus de vingt-cinq ans) que les ligaments latéraux des articulations des phalanges, sont placés plus près de la partie antérieure que de la partie postérieure des articulations, de telle sorte qu'ils permettent, favori-



sent et déterminent plutôt la flexion que l'extension. Il résulte de cette disposition que, dépouillées de leurs tendons et de leurs coulisses tendineuses, les articulations se fléchissent naturellement. Mais elles peuvent alors être facilement redressées, ce qui n'a pas lieu dans la maladie dont nous parlons. Enfin, quelques personnes ont pu penser que la rétraction des doigts tenait à une sorte de *crispature des tendons* (*crispatura tendinum*), opinion qui se rapproche de la vérité plus qu'aucune autre, si l'on transporte le siège de la crispature à des parties autres que les tendons.

Le nombre de ces causes, outre qu'elles sont pour la plupart insignifiantes, invraisemblables ou contradictoires, aurait suffi seul pour les faire rejeter. Il n'existait qu'un moyen de dissiper l'obscurité qui régnait sur le diagnostic, et par suite sur le traitement de la rétraction des doigts, c'était la dissection attentive des parties qui sont affectées de cette maladie. J'ai long-temps cherché cette occasion sans la rencontrer; je l'ai inutilement demandée aux hôpitaux, aux amphithéâtres et à la ville. Elle s'est enfin présentée, et non-seulement j'ai disséqué, mais encore j'ai fait représenter, couche par couche, une main affectée de rétraction, depuis la peau jusqu'aux os. Celui de ces dessins qui (p. 355) représente la main avant toute dissection, semblerait avoir été fait sur notre malade, tant est grande la ressemblance entre sa maladie et celle que j'ai fait représenter. (M. Dupuytren fait passer ce dessin, qui offre, en effet, une grande apparence de conformité avec le cas du cocher de fiacre).

La main que j'ai disséquée était celle d'un vieillard mort avec cette affection, qu'il portait depuis fort long-temps, et la dissection m'a fait connaître que les diverses causes ci-dessus indiquées, étaient tout-à-fait étrangères à la production de la rétraction des doigts. En effet, la peau qui formait les plis dont j'ai parlé, étant enlevée, ceux-ci disparurent complètement, et elle fut trouvée d'épaisseur et de consistance naturelles; ce qui prouva que les plis lui avaient été communiqués, et qu'ils n'étaient pour rien dans la production de la maladie. L'aponévrose palmaire était intacte, mais tendue, rétractée et diminuée de longueur; de sa partie inférieure on voyait naître des espèces de

colonnes qui se rendaient sur les côtés des doigts rétractés. Les efforts que l'on faisait pour redresser ceux-ci, augmentaient la tension de ces cordes et celle du tendon du palmaire grêle. Alors seulement je commençai à soupçonner que l'aponévrose palmaire pouvait être pour quelque chose dans cette maladie.

Je ne voulus pas m'en tenir à ces apparences, quelques fortes qu'elles fussent. Je coupai donc en travers les tendons des fléchisseurs de l'un des doigts rétractés, en conservant intacte l'aponévrose palmaire et ses prolongements, et la rétraction de ce doigt persista dans toute sa force. Je coupai ensuite l'aponévrose palmaire du doigt voisin, en laissant entiers les tendons de ses fléchisseurs, et immédiatement le doigt put être étendu sans effort, autant que dans l'état naturel. Ces faits ne pouvaient laisser aucun doute, et, dès-lors, je regardai comme une chose démontrée, que le (p. 356) rétraction de l'aponévrose palmaire était la seule et unique cause de la rétraction des doigts.

Néanmoins, continuant religieusement ma dissection du membre, je remarquai que les tendons n'avaient changé ni de volume, ni de forme; que les surfaces articulaires étaient intactes, ainsi que les synoviales qui les recouvrent, et celles qui tapissent les coulisses des tendons. Les ligaments étaient sans changements de forme, de volume, de rapports et de situation, les os parfaitement sains, tant à l'intérieur qu'à l'extérieur.

Je restai donc convaincu que la tension des prolongements de l'aponévrose palmaire, était la seule cause de la rétraction des doigts.

L'ignorance de la nature et des causes de la maladie, avait toujours empêché d'arriver à un traitement convenable, et cette maladie était généralement regardée comme incurable. Quelques praticiens, pour faire quelque chose, et sur-tout pour calmer l'imagination des malades, ont conseillé une multitude de remèdes, que ont été tous infructueux. J'ai fait l'épreuve de ces remèdes, et c'est sans aucun succès que j'ai employé successivement, sur la même personne, les fumigations émollientes, calmantes; les cataplasmes émollients pendant la nuit et même pendant le jour; des sangsues à la paume de la main; pour satisfaire un médecin, qui pensait qu'il existait une inflammation des coulisses tendineuses;

les pommades résolutives, mercurielles et autres, les douches d'eau simple, d'eau sulfureuse, d'eau alkaline, savonneuse, etc., je n'obtins rien. Fatigué de cette résistance opiniâtre du mal, je mis en usage l'extension continuelle, à l'aide d'une machine imaginée par Lacroix, et qui consistait en une gouttière en fer blanc, matelassée à sa face interne, placée à la face postérieure du membre, et présentant à son extrémité inférieure quatre digitations terminées en demi-cylindres, pour recevoir le bout des doigts. Cette (p. 357) machine ne servit à rien, si ce n'est à causer de très fortes douleurs, quand la tension était portée à un haut degré.

Deux fois j'ai vu couper les tendons des fléchisseurs; dans un cas, la section fut faite au milieu du doigt; il survint, après cette opération, une inflammation grave, qui s'étendit dans la coulisse synoviale, se compliqua d'étranglement, et qui, se propageant au loin, mit les jours du malade en danger. Il n'y eut aucune amélioration dans l'état du doigt. Dans l'autre cas, la section du tendon fut faite plus bas, et il ne survint, après l'opération, que des accidents légers; mais il n'y eut pas plus d'amélioration que dans le premier cas.

L'inutilité de ces traitements devait être bien reconnue, pour que la premier et le plus respectable de nos praticiens, M. Boyer, en fût venu au point de regarder cette maladie comme incurable, et de conseiller positivement, dans son grand et consciencieux ouvrage, de ne l'attaquer par aucune opération; et pour que sir Astley Cooper, praticien non moins distingué, dans un pays voisin, donnât, ainsi que le rapporte M. Bennati, un conseil tout-à-fait semblable à M. Férari, maître de piano, qui le consultait sur la rétraction des doigts de l'une des mains, laquelle rétraction l'avait forcé à cesser l'exercice de sa profession.

La cause de cette rétraction une fois reconnue et constatée, il restait encore à trouver le remède propre à la détruire et à rendre aux doigts leur mobilité. L'inefficacité, tant de fois démontrée, de tous les moyens employés contre cette maladie, avait assez prouvé l'inutilité d'y avoir recours de nouveau. Ces remèdes ne pouvaient pas avoir acquis une vertu plus grande, par cela seul qu'il avait été découvert que la rétraction des doigts était dans la crispation de l'aponévrose palmaire. Il me parut que la section

des brides formées par cette aponévrose, serait le remède le plus prompt et le plus efficace contre cette maladie. Il me parut d'ailleurs (p. 358) que cette section serait facile, à cause de la situation de ces brides sous la peau immédiatement; enfin, il me sembla qu'elle pouvait être faite avec d'autant moins de risques, de danger d'inflammation et d'étranglement, que ces brides devaient être coupées en travers, et qu'elles le seraient plus largement.

Mais il fallait pour cela trouver une occasion: elle me fut présentée par M. le docteur Mailly, qui a pris soin de reproduire, dans l'observation suivante, les circonstances principales de cette première opération."

CONTRACTURE DU PETIT DOIGT ET DE L'ANNULAIRE DE LA MAIN  
GAUCHE, DISSIPÉE COMPLÈTEMENT PAR LE SIMPLE  
DÉBRIDEMENT DE L'APONÉVROSE PALMAIRE

En 1811, M. L. . . . , marchand de vins en gros, quai de la Tournelle, n° 25, ayant reçu un grand nombre de pièces de vins du Midi, pièces qui sont ordinairement fort volumineuses, et voulant aider ses ouvriers à les ranger dans son magasin, en les entassant les unes sur les autres, ce qu'on appelle, en termes de commerce, *gerber*, essaya de soulever l'une d'elles, en plaçant la main gauche au-dessous du rebord saillant formé par l'extrémité des douves, et ressentit au même instant un craquement et une légère douleur dans la partie interne de la paume de cette main. Il conserva, quelque temps ensuite, de la sensibilité et de la raideur dans cette même main; cependant peu à peu ces symptômes se dissipèrent, en sorte qu'il y fit peu d'attention, et que ce ne fut qu'au bout d'un certain temps qu'il s'aperçut que l'annulaire tendait à se rétracter et à s'incliner vers la paume de la main, sans pouvoir être relevé autant que les autres. Mais la douleur n'existant plus, il négligea cette légère difformité commençante. Toutefois, celle-ci persista à augmenter de mois en mois et d'année en année, au point que, vers le commencement de cette année (1831), l'annulaire et le petit doigt étaient tout-à-fait fléchis et couchés sur la paume de la main, la seconde phalange pliée sur la première, et l'extrémité (p. 359) de la troisième appliquée sur le

milieu du bord cubital de la surface palmaire. Le petit doigt, moins fléchi, était néanmoins incliné d'une manière invariable vers la paume de la main. La peau de cette dernière partie était plissée, et entraînée vers la base des deux doigts rétractés.

M. L. . . . , fatigué de voir cette incommodité s'accroître de jour en jour, et désirant vivement en être débarrassé, à quelque prix que ce fût, consulta plusieurs médecins. Tous pensèrent que la maladie avait son siège dans les tendons fléchisseurs des doigts affectés, et qu'il n'y avait d'autre remède efficace que la section de ces organes: les uns voulaient couper les deux tendons à la fois, et les autres n'en diviser qu'un seul. Consulté à son tour, M. Mailly pensa de même, que la maladie était probablement due à une rétraction des tendons fléchisseurs, par suite d'inflammation et d'adhérences de leur gaine; mais il manifesta la plus grande répugnance pour toute opération sur ces cordons fibreux; il savait que cette affection était indiquée, plutôt que décrite, sous le nom de *Crispatura tendinum*, dans l'ouvrage de M. Boyer, et que cet habile chirurgien proscrivait toute espèce d'opération sur ces tendons; du reste, il conseilla au malade de s'en remettre complètement à l'expérience de M. Dupuytren. A peine ce professeur eût-il vu le malade, qu'il déclara que cette affection n'avait point son siège dans les tendons, mais bien dans l'aponévrose palmaire seulement, et que quelques débridements pratiqués sur cette aponévrose, suffiraient pour rendre aux doigts rétractés toute la liberté de leurs mouvements. C'était un résultat sur lequel ses savantes recherches d'anatomie pathologique lui permettaient de compter. En conséquence, l'opération fut convenue et arrêtée pour le 12 de juin courant, et M. Dupuytren, aidé par M. Mailly et l'un de nous (M. Marx), y procéda de la manière suivante:

La main du malade étant solidement fixée, il commença (p. 360) par faire une incision transversale de dix lignes d'étendue, vis-à-vis l'articulation métacarpo-phalangienne du doigt annulaire. Le bistouri divisa d'abord la peau, puis l'aponévrose palmaire, avec un craquement sensible à l'oreille. A peine l'incision fut-elle achevée, que le doigt annulaire se redressa et put être étendu presque aussi facilement que dans l'état naturel. Désirant éviter

au malade la douleur d'une nouvelle incision, M. Dupuytren essaya de prolonger la section de l'aponévrose, en glissant le bistouri transversalement et profondément au-dessous de la peau, du côté du bord cubital de la main, et d'arriver à dégager ainsi le petit doigt. Mais ce fut en vain; il ne put que légèrement dilater l'incision de l'aponévrose, et le petit doigt n'en acquit aucun dégagement. En conséquence, il se détermina à pratiquer, de nouveau, une incision transversale vis-à-vis l'articulation de la première et de la seconde phalange du petit doigt, et détacha ainsi son extrémité de la paume de la main. Mais le reste du doigt se tint fixé invariablement vers cette partie. Alors une seconde incision divisa la peau et l'aponévrose, vis-à-vis l'articulation métacarpo-phalangienne correspondante. Elle procura un léger dégagement, mais son effet était encore incomplet. Enfin, une troisième et dernière incision fut pratiquée en travers, vis-à-vis le milieu de la première phalange elle-même, et aussitôt le petit doigt put être étendu avec la plus grande facilité; d'où on peut penser que cette dernière division intéressa probablement le point d'insertion de la digitation aponévrotique. Un écoulement de sang, peu considérable, succéda aux incisions. On pansa avec de la charpie sèche; puis on assujettit le petit doigt et l'annulaire dans l'extension, à l'aide d'une machine appropriée et fixée sur le dos de la main.

Le jour de l'opération, et la nuit suivante, peu, et même point de douleur; seulement gêne légère causée par l'extension continuelle. Le lendemain matin, le dos de la main est (p. 361) le siège d'un empâtement léger, résultat de la compression de la machine, qui avait été construite d'une manière assez grossière, par un bandagiste peu au fait de ce genre d'appareils. Le soir, la douleur et la tension des parties augmentent. Le 14, au matin, on substitue une machine, plus habilement confectionnée par Lacroix. Le malade semble éprouver d'abord du soulagement; mais le soir, l'irritation se réveille, la douleur redouble, et la main est envahie par un gonflement général. Alors, sans enlever la machine extensive, on arrose constamment la main d'une solution d'extrait de saturne dans de l'eau froide. Sous l'influence de ces ablutions fréquentes, la douleur et la tension diminuent,

et l'état du malade devient plus supportable. Le 15, on lève la charpie, et on trouve la suppuration à peine établie; la main est encore engorgée, et une douleur tensive, mais tolérable, se fait ressentir dans toute l'étendue des doigts redressés. On maintient la tension au même degré, et on fait continuer les fomentations saturnines. Le 16, il n'y a plus qu'un léger empâtément de la main, une raideur dans les doigts; la suppuration est complètement établie. Le 17, les symptômes ont encore décréu, et on peut augmenter la tension des doigts de quelques degrés, sans produire de douleur au malade. Enfin, les jours suivants, l'empâtément et la tension se dissipent et les plaies marchent vers leur cicatrisation, d'une manière lente, il est vrai, à cause de l'écartement que produit entre leurs lèvres la position forcée dans laquelle la main est maintenue à dessein. Néanmoins la cicatrisation est complète dans toutes les plaies, le 2 juillet, et elle a suivi une progression successive, en rapport avec le degré différent d'influence que l'extension exerçait sur chacune d'elles. Ainsi, l'on vit successivement se fermer: 1° celle qui correspondait à l'articulation de la première et de la deuxième phalanges du doigt annulaire; 2° celle qui était vis-à-vis la partie moyenne de cette même première phalange; (p. 362) 5° celle qui était en rapport avec l'articulation métacarpo-phalangienne du petit doigt; 4° enfin, celle qui avait été pratiquée la première, et qui correspondait à l'articulation métacarpo-phalangienne de l'annulaire. Du reste, le malade a dû conserver encore l'usage de la machine extensive, pendant au moins un mois, afin de s'opposer au rapprochement et à l'affrontement des bords des sections aponévrotiques, et en obtenir la cicatrisation isolée. Néanmoins, à cette époque, lorsqu'on enlève la machine, on voit que le malade peut facilement fléchir les doigts, et qu'il n'en est empêché que par la raideur dans laquelle l'état d'extension continuelle tient les articulations. Mais cette raideur sera bientôt dissipée, dès qu'on permettra au malade de se livrer à quelques mouvements.

Le 2 août, M. Mailly vient de revoir M. L. . . . Il ne porte plus la machine extensive que la nuit, et déjà ses articulations commencent à prendre un léger degré de souplesse, qui permet de

juger que l'usage des tendons fléchisseurs est resté intact, et que, dans quelques temps, les mouvements des doigts seront rétablis dans leur état naturel, tout en conservant la faculté d'être relevés et tendus autant que ceux qui n'ont pas été affectés.

Aujourd'hui, 5 décembre, le malade est dans un état de parfaite guérison.

“Ce succès s'explique aussi bien que les divers phénomènes que présente la maladie. En effet, si l'on examine la disposition anatomique des parties, on trouve que la peau est unie d'une manière intime à l'aponévrose palmaire, par un tissu cellulaire dense, serré et fibreux, et dans lequel se trouve peu de graisse, d'où les plis qui s'y font quand l'aponévrose se raccourcit. Les quatre faisceaux de l'aponévrose, qui vont se rendre à l'extrémité supérieure des premières phalanges et s'insérer au ligament métacarpien transverse inférieur, (p. 363) après s'être bifurqués pour le passage des tendons des fléchisseurs, sont les parties que se tendent et qu'il faut couper, pour restituer aux doigts leur liberté. Mais dans ce point se trouvent les vaisseaux et nerfs qui vont se rendre aux doigts, et qu'il faut éviter d'inciser. Heureusement, quand les doigts sont rétractés, ces languettes forment une espèce de pont, sous lequel passent les vaisseaux et nerfs; ce qui laisse un assez grand espace pour faire les incisions nécessaires et sans risques.

Les plus nombreuses et les plus fortes d'entre les fibres de l'aponévrose sont longitudinales, aussi ce sont elles qui, étant affectées, ont la plus grande part dans les phénomènes que présente la maladie. C'est de haut en bas qu'elles agissent, et elles jouent le principal rôle dans la rétraction des doigts.

L'aponévrose palmaire a d'abord pour fonctions de contenir les muscles et les tendons qui traversent la paume de la main; mais elle en a encore d'autres, c'est de tendre à ramener sans cesse, et sans le concours des muscles, les doigts dans l'état de demi-flexion, qui est aussi leur état de repos. Cette dernière fonction est sur-tout bien manifeste chez certains animaux, et particulièrement chez les oiseaux qui doivent se percher, et chez lesquels l'aponévrose est douée d'une grande puissance d'élasticité,



qui opère la flexion des doigts avec beaucoup de force. C'est l'exagération de cette fonction, chez l'homme, qui donne naissance à la maladie que nous venons de décrire."

Après avoir donné les explications impartiales que nous venons de rapporter, M. *Dupuytren* a procédé à l'opération sur le cocher atteint de cette rétraction des doigts. Voici comment cette opération a été pratiquée, sur la main droite seulement.

(p. 364) Une incision demi-circulaire et transversale, de dix lignes d'étendue à peu près, fut faite à la base du doigt annulaire de la main droite et sur sa face palmaire, afin de couper les prolongements digitaux de l'aponévrose. Un craquement très sensible à l'oreille des assistants, signala l'instant de cette section. Une autre incision transversale fut faite à un pouce et quart de la première, au-dessous d'elle et plus en-de-dans, dans la paume de la main; elle eut à peu près huit lignes d'étendue; elle servit à séparer de sa base les prolongemens digitaux de l'aponévrose, qui se rendent au petit doigt, qui avait lui-même quelque tendance à la flexion. Immédiatement après, on vit le doigt annulaire et le petit doigt se redresser et reprendre presque entièrement leur rectitude ordinaire. Un pansement simple fut fait. On doit employer sur ce malade la machine imaginée par Lacroix pour cette affection. Nous rendrons un compte des suites de cette opération et de celle qui sera pratiquée plus tard sur l'autre main.

L'opération terminée, M. *Dupuytren* a achevé cette leçon ainsi qu'il suit:

"Les faits que je viens d'exposer, l'opération qui vient d'être faite sous vos yeux, établissent, d'une manière incontestable, que la rétraction des doigts tient, dans les cas et avec les signes que j'ai indiqués, à une rétraction de l'aponévrose palmaire, et particulièrement des prolongements qu'elle envoie à la base des doigts; que cette maladie peut être guérie, par la section en travers de ces prolongements et de la partie de l'aponévrose qui les fournit.

"Trois faits ne sauraient, j'en conviens, établir une doctrine générale, mais ces faits ne sauraient manquer d'éveiller l'attention des érudits et celle des praticiens, et il est probable que cet éveil deviendra profitable à la science et à (p. 365) l'humanité, en

multipliant les observations sur les causes, les signes, les effets et le traitement de cette maladie, et principalement sur l'opération que j'ai imaginée pour la guérir.

“J'appelle ces observations de tous mes vœux, dussentelles être contradictoires avec les miennes; car ce que je désire, avant et par-dessus tout, c'est ce qui peut être utile à l'humanité, à laquelle j'ai voué mes facultés et mes veilles.

“Mais je dois dire à l'avance que tous les cas analogues ne se ressemblent pas sous tous les rapports, que partant toutes les méthodes ne leur sont pas applicables, et que les meilleures peuvent être dépréciées, je dirais même déshonorées, par de fausses applications. Telle serait, par exemple, celle que l'on ferait de la méthode, que nous venons d'employer sur ce malade, à des rétractions des doigts, produites par des rhumatismes, la goutte, des panaris, des inflammations chroniques, etc.

“L'insuccès, en pareil cas, ne prouverait rien autre chose que le défaut de discernement de la part de celui qui emploierait cette méthode dans des circonstances différentes de celles que nous venons d'exposer.”

M. Dupuytren a promis, lorsque l'occasion s'en présenterait, de parler de la rétraction de l'aponévrose plantaire, rétraction qui est encore plus commune que celle de l'aponévrose palmaire, et dont les effets, sur les orteils, ne sont pas moins importants que ceux de l'aponévrose palmaire sur les doigts.

FINI



# Permanent Retraction of the Fingers, Produced by an Affection of the Palmar Fascia

Clinical Lectures on Surgery, Given at the Hotel Dieu, Paris

BY

BARON DUPUYTREN\*

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**R**ETRACTION of the fingers, Gentlemen, and particularly that of the ring-finger, has been observed for many years, but it was only very lately that the cause of this deformity has been investigated with success. If we consider the multitude of reasons assigned as a cause of this disease, the quantity of remedies proposed for its cure, and the various hypotheses put forth on its origin, it is not surprising that many surgeons should have regarded it as incurable. Authors have spoken in a very incomplete manner upon this subject. Boyer, in his treatise on surgical diseases, has given to it a few words under the name, *erispatura tendinum*. Perhaps those who have more leisure may find some description of it in authors; if this be the case, I shall be happy to learn that those who have preceded me have discovered the cause and means of cure.†

\*Lecture delivered during the session of 1833. Revised, before translation, by the Baron himself.

†Sir A. Cooper, many years ago, described this affection, and pointed out its true cause. It is strange that the chief of the Hotel Dieu should be so little acquainted with the writings of his "brother in surgery," as he is wont to call Sir Astley. Ed. L. (Original note)

It has at different times been attributed to a rheumatismal affection, to gout, some external violence, a fracture, or the metastasis of some morbid cause, as we occasionally find in cases of inflammation of the sheaths or tendons of the flexor muscles; we shall see presently on what little foundation these pretended causes rest. The greater number of individuals affected by this disease have been obliged to make efforts with the palm of the hand, or frequently to handle hard bodies. Thus the wine-merchant and coachman of whom we shall presently speak were obliged, the one to perforate continually the casks with a gimlet, the other to ply his whip unceasingly on the backs of his jaded horses: it is also seen in masons who lift stones with the extremities of the fingers, in ploughmen, &c.; hence we see that the disease occurs most frequently in those who are forced in working to make the palm of the hand a *point d'appui*. Individuals who are predisposed to the disease of which we speak, perceive that they extend the fingers of the injured hand with less facility than usual; the ring-finger soon begins to contract; the deformity first attacks the extreme phalanx, and the others follow its movement: as the disease advances, the finger becomes more contracted, and the flexion of the two neighbouring fingers begins to be remarked. We do not feel any nodosity in front of the chord which runs along the palmar surface of the ring-finger; the two last phalanges are straight and movable at this period; and the last one is bent nearly at a right angle on the metacarpal bone, but still retains some motion; in this state it cannot be brought to its original position by the most violent effort. A person attacked by this infirmity attached to his finger a weight amounting to 150 pounds, without influencing in the least the degree of flexion. When the ring-finger is flexed to a great degree, the skin presents various folds, the concavity of which looks towards the articulation of the wrist. At first sight we might imagine that the skin was diseased, but dissection proves that the skin remains unaltered, and that the folds depend on adherences of the integument to the altered parts beneath. If we touch the palmar surface of the ring-finger, we find a tightly-stretched chord there; the summit of this chord is directed towards the

extremity of the phalanx and it may be followed to the superior part of the palm of the hand; by flexing the finger this chord is made to disappear, and if we endeavour to extend it, we find that the tendon of the palmaris brevis is moved, and the motion propagated to the upper part of the palmar fascia; this effect depends on the continuity of these parts, and we shall have occasion presently to direct your attention more particularly to the circumstance.

But you may ask, what are the inconveniences of this affection? As the ring-finger cannot be extended, the motion of the two neighbouring fingers is much limited; the patient can only seize a very small body; if he attempt to grasp it strongly, he feels great pain; the very act of catching any body is painful. I have seen from thirty to forty examples of this disease, and have heard almost as many causes assigned to it. Some have regarded it as a thickening and contraction of the skin, not considering that the integument is drawn down on itself by the operation of the cause which produces the disease originally; others make it depend on a spasmodic contraction of the muscles; but this idea is purely hypothetical, for excepting extension, all the other movements of the finger are easily executed. The greater number of surgeons conceive this disease to be connected with some affection of the flexor tendons, and I myself adopted this view of the subject; but we still wanted to know the precise nature of the affection; was it inflammation, engorgement, adhesion of the cellular tissue, or some chronic disease of the parts?

Dissection alone could resolve these questions, which it did by showing that none of the presumed alterations existed. If we examine the articulations of the finger, we shall see that the surfaces are very extensive, and that they are united so as to favour flexion more than any other motion. The lateral ligaments, placed in either side of the joint, present a disposition which it is important to notice; they are placed closer to the anterior than to the posterior surface of the finger; hence the latter has a greater tendency to flexion than to extension. Such is an hypothesis that seems to have some value, but it falls before facts which we shall presently adduce; besides, it cannot be applied with any

show of reason to men in the height of youth. Finally, there are some surgeons who attribute the retraction of the fingers to a disease of the joint, which causes the ankylosis of the articulation.

Dissection of a Case.—But let us not dwell any longer on these different suppositions, which I have merely noticed as they are connected with the history of the disease. The important thing to know is, that some obstacle exists, and that we ought to seek out its cause.

Such was a general view of our knowledge upon this point, when a man, who had been for a long time affected with this disease, happened to die. I had kept my eye on him for some years, and was determined not to lose this opportunity of investigation. Accordingly I possessed myself of the arm of this man, had the state of the parts accurately drawn by an artist, and then proceeded to dissect them. When the skin was removed from the palmar surface of the hand and fingers, the folds which I have before noticed, disappeared altogether. It was evident then that the folded arrangement of the skin during life depended on some other affection; but what was this? The dissection was continued by exposing the palmar fascia, and I was astonished to perceive that this fascia was tense, retracted, and shortened. From its lower portion were given off kinds of chords, which passed to the diseased finger. In flexing and extending the fingers, I could clearly see that the fascia underwent a sort of tension, or crackling; this was a trace of light, and made me suspect that the aponeurosis had some connexion with the complaint. But the precise point affected remained to be discovered. I cut through the prolongations extending from the fascia to the fingers; the state of contraction immediately ceased, and the slightest effort was sufficient to bring them to complete extension; the tendons were all sound, and the sheaths had not been opened; but in order to leave no doubt on the subject, I examined the tendons with care. Their surfaces were smooth, and they enjoyed their usual degree of motion; the joints also were in a healthy state, the bones were neither swollen nor changed in any degree. I could distinguish no alteration of the articular surfaces or ligaments. The synovial membranes, and synovial cartilages, all

were sound. It was, therefore, natural to conclude that the disease commenced in an exaggerated tension of the palmar fascia, which depended on the violent or long-continued action of some hard body on the palm of the hand.

Treatment of the Affection.—The various opinions held on the cause of this disease must of necessity have exercised great influence on the therapeutics. Many practitioners have thought that it was incurable. Dr. BENNATI, having consulted Sir A. COOPER on the case of an Italian named Ferrari, who was affected with this deformity, was told by that celebrated surgeon that the disease was incurable. Others, while they admit the possibility of a cure, have proposed different methods, the great number of which alone is sufficient to prove their inefficacy. I have in my time treated a great number of patients successively with fumigations, cataplasms, leeches, and ointments, especially the mercurial. I have employed alkaline douches, simple and sulphur douches, without any success. Finally, fatigued by being always defeated, I prescribed permanent extension, which also failed, having given rise to excessive pain in the palm of the hand when the extension was long continued. Some surgeons had proposed the division of the flexor tendons, and this method was tried upon two occasions; in the middle, inflammation immediately set in, and the life of the patient was brought into danger. In the other case, the tendon was cut much lower down; no accident followed, but the finger remained as much flexed as ever. It was several years after these operations that I was consulted by Dr. MAILLY for a similar case.

#### CASES OF CONTRACTION OF THE RING AND LITTLE FINGERS COMPLETELY CURED BY DIVISION OF THE PALMAR APONEUROSIS

Case I.—In 1811, M. L., wine-merchant, having received from the South a great deal of wine, was desirous to assist his workmen in arranging the casks in the store. While endeavouring to raise one of the casks, which was very heavy, by placing his hand under the edge of the stave, he felt a sensation of cracking, and a slight pain in the palm of the hand. For some time the part remained stiff and sensible, but these symptoms soon went

off, and he paid little attention to the state of his hand. The accident was nearly forgotten, when he perceived that the ring-finger commenced to contract towards the palm of the hand, and could not be extended as much as the other fingers. As there was no pain, he neglected this slight deformity. By degrees the disease advanced, and made a sensible progress each year, so that in 1831 the little and ring fingers were completely flexed, and applied to the palm of the hand; the second phalanx was folded on the first, and the extremity of the third applied to the middle of the ulnar edge of the palmar surface. The small finger was strongly flexed on the palm of the hand; and the skin of this part was folded, and dragged towards the retracted fingers.

The patient, annoyed by seeing this deformity getting daily worse, consulted several surgeons, who all said that the disease existed in the flexor tendons, and advised their section as the only remedy; but some would cut both tendons, whilst others proposed to divide only one. M. MAILLY, being consulted in his turn, thought that the disease was probably situated in the flexor tendons, but advised the patient to see me on the subject. The moment I saw the man's hand I recognized the affection of the palmar fascia, declared the disease was not situated in the tendons, and that a few incisions practised in the aponeurosis would be sufficient to restore entire freedom of motion to the finger.

Operation:—The hand of the patient being firmly fixed, I commenced the operation by making a transverse incision nearly an inch long, opposite the metacarpo-phalangean articulation of the ring finger; the bistoury divided first the skin and then the palmar fascia, with a crackling sound perceptible to the ear; after this incision the ring-finger recovered its position and could be extended nearly as completely as ever. As I was desirous to spare the patient the pain of a new incision, I attempted to prolong the division of the fascia, by gliding the bistoury deeply under the skin towards the ulnar edge of the hand, in order to free, if possible, the little-finger, but this attempt failed. I was in consequence obliged to make another transverse incision opposite the articulation of the first and second phalanx of the little-



finger, which enabled me to detach it from the palm of the hand, but the rest of the finger remained obstinately fixed towards this part. A new incision, however, divided the skin and fascia opposite the metacarpal joint of the finger, to give it some slight liberty; finally, a third transverse cut was made opposite the middle of the first phalanx, and immediately extension of the finger was easily accomplished; this proved clearly that the last incision had divided the point of insertion of the fascial process. The wounds were simply dressed with dry lint, and the fingers kept in a state of extension by a suitable apparatus.

Progress of the Case.—Next day little pain; merely some uneasiness from the continued extension. On the following day the back of the hand was slightly oedematous from the pressure of the apparatus, which was clumsily made; another was applied, but the state of irritation continued, great pain set in, and the hand became much swollen. Not wishing to remove the machine applied to extend the fingers, I ordered the hand to be bathed continually with Goulard's solution, which gave considerable relief. On the 15th the lint was removed, and we found some little suppuration had set in; the hand was still swollen and painful. Extension was continued to the same degree as formerly, and the cold lotion applied. On the 16th the swelling had abated considerably, the fingers remained stiff, and suppuration was fully established. 17th. The symptoms were more favourable, and the extension could be increased somewhat without determining any pain. Finally, in the course of some days the swelling of the hand disappeared, and the wounds were healed on the 2nd of July.

The cause of this slowness in the cicatrization depended, without doubt, on the forced extension in which the fingers were constantly kept. The patient continued to carry the apparatus for another month, in order to oppose the reunion of the edges of the divided fascia; and when at length this was removed, we had the satisfaction of seeing that he could flex his fingers with facility, and that the stiffness which remained was only due to the forced extension in which the articulations were held for so long a time; but this rigidity disappeared when the patient had, for a short time, resumed his accustomed exercises.

Remarks.—This case can leave no doubt of the nature of the disease; but we may be inclined to ask, how can the palmar fascia determine similar effects? To answer this question, we must recall to your memory a few anatomical particulars concerning this fibrous envelope. The superficial palmar fascia is partly formed by the expansion of the tendon of the palmaris brevis, and of the anterior portion of the annular ligament of the wrist. Though very strong at its origin, it thins by degrees, and sends off from its inferior margin four fibrous slips, which pass towards the inferior extremity of the four last metacarpal bones; here each of these slips bifurcates for the passage of the flexor tendons, and each branch of the bifurcated slip passes on to be attached to the *side*, and not to the front, of the phalanx, as most anatomists have thought. These are the slips of fascia which should be cut, whenever the operation becomes necessary. When we dissect off the skin from the fascia beneath, we find a certain difficulty in separating it, because the cellular tissue is dense, and because various fibrous filaments pass from the fascia into the integument; these adhesions explain readily the wrinkled state of the skin, and its motion. At first sight we might be inclined to dread cutting the nerves and vessels of the finger, but these parts are well protected by a kind of bridge formed by the contracted fibres, and run no risk of being divided.

The uses commonly attributed to the palmar fascia are to sustain the tendons of the flexor muscles, to strengthen the arch of the hand, and protect the different vessels and nerves there contained; but in addition to these, it tends constantly to bring the fingers to a state of demiflexion; which is their state of repose, and it is nothing more than the excess of this function, produced by disease, which gives rise to the deformity of which I now speak.

Case 2. The subject of this operation was a coachman aged about 40. Several years back his fingers began to contract, especially the ring-finger. When he came to the Hôtel Dieu, the fingers were so much flexed that they nearly touched the palm of the hand; and this part formed numerous folds of skin, the convexity of which was turned towards the fingers. When we attempted to extend the fingers, we felt a chord stretching from them to the palm of the hand; both hands were affected by

the disease, which could not be mistaken, from its history, and the symptoms before us. When the hand was seized, and the fingers moved, the tension of the fascia became manifest; I immediately divided with a curved bistoury the skin and fascia by two incisions, one at the base of the ring-finger, in order to cut the two slips of fascia passing to it; the second at about an inch and a quarter below the other, in the palm of the hand, in order to divide this prolongation, a second time, and at the point where its base joined the palmar aponeurosis. After three incisions the ring-finger recovered very nearly its normal position; though little blood was lost, the patient felt himself weak, I therefore deferred operating on the left hand until another day. It is unnecessary to pursue the history of this case any further, as the treatment and success were exactly similar to the case already mentioned to you.

Concluding Remarks.—The facts which you have just heard, Gentlemen, establish, incontrovertibly, that retraction of the fingers depends, in these cases, on a retraction of the palmar fascia, and chiefly that part of it which is prolonged on the base of the fingers; and, finally, that this disease may be cured by the transverse sections of these slips, and of the fascia which furnishes them. These facts are not, indeed, sufficient to establish any general doctrine, but they will not fail to awaken the attention of practitioners; and it is, I hope, probable that these hints may become useful to science and humanity, in multiplying observations on the cause, symptoms, and treatment of this disease. But we should remark, that all analogous cases do not strictly resemble one another, that various methods of cure shall be applied to various diseases, and that the very best may lose their reputation by being applied without care or discrimination; such, for example, would be the fate of the method I have indicated, if it were employed against retraction of the fingers caused by gout, rheumatism, whitlow, or other similar diseases.



# Of Fractures of the Lower Extremity of the Fibula, and Luxations of the Foot

From Clinical Lectures on Surgery, Delivered at Hotel Dieu, in 1832

BY

BARON DUPUYTREN

*Translated from the French by A. Sidney Doane, A.M., M.D.*

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## GENERAL REMARKS

**O**F THE two bones of the leg, fractures of the fibula occur less frequently than those of the tibia, although it is weaker and more exposed to external injury. This peculiarity is explained, said M. Dupuytren, by its insulation from the line in which the weight of the body is transmitted to the foot. The elasticity of this bone even in old age, the little weight sustained by most of it, the protection it receives anteriorly from the muscles which fill the interosseous space and even from the tibia, posteriorly from the gastrocnemii and soleus, and on the outside from the peronei muscles, tends to weaken the effect of bruises upon it, and to diminish the number of its fractures. We must remark that many of its lesions have often been mistaken, that others in many cases have been confounded with luxations of the tibiotarsal articulation, so that in fact they are much more frequent than most authors admit. Farther, M. Dupuytren estimates that the fractures

of the lower extremity of the fibula alone, are to the rest of the fractures of the bones of the leg, as one to three.

Some of the causes which produce fractures of the fibula, operate directly upon it: others act on it through the medium of the foot: hence two kinds of fractures: those near the middle and upper extremity of the bone, and fractures of the malleolus: these two kinds of fractures differ in three respects, viz.: their causes, their effects, and the treatment to be employed.

The situation of the body of the fibula on the outside of the leg, the thinness of the bone, the space between it and the tibia near the middle of the leg, the support of its two extremities on the tibia, these facts would induce us to think that fractures of it would occur most frequently in its centre: this, however, is not the case. Two causes diminish the frequency of these fractures: the support which the fibula receives from the peroneus longus and brevis muscles, and the few circumstances which can directly cause a fracture.

These fractures are generally caused by the action of force directly on the bone, and are produced by blows on the fibula, from cutting or bruising bodies, by fire-arms, by the fall of heavy bodies on the outside of the leg, or by these bodies passing over it. They do not suppose and they do not require any muscular power. Hence they generally occur without being usually preceded or followed by any dislocation of the foot, either inward or outward, and in most cases, are cured by rest, and without being attended with any of the bad symptoms which are so frequently complicated with those produced by the dislocation of the foot. These fractures, said M. Dupuytren, are remarkably analogous with those of the ulna, which are seldom caused separately except by forces applied directly to the point upon which they act.

Fractures of the body or upper part of the fibula, when the tibia is uninjured, present no displacement in the direction of the length of the fragments: the foot preserves its normal direction, and we hardly perceive at the place of the fracture, a depression caused by the slight sinking of the bony parts. The diagnosis of injuries of this kind may be somewhat obscure,

especially if the swelling has time to develop itself. The circumstances of the injury, the violence of the blow on the leg, or the weight of the body which bruised the limb; the existence of an extensive ecchymosis, of a deep contusion in the affected region: the ease with which the finger on passing over the external surface of the fibula is depressed in this part, and pushes the extremities of the fragments towards the tibia; such are the principal signs which must serve as a foundation for the surgeon's opinion. The motions of the foot and those attempted to be communicated to the extremities of the bone, are seldom attended with evident crepitation, on account of the thinness of the fragments and the exactness of their relations.

Fractures of the body of the fibula are not attended with shortening of the limb, because the tibia serves as a splint for it. They are rarely serious, except, when complicated with considerable lacerations of the soft parts. In simple cases, nature is almost sufficient for the cure; and the indications, in cases of fracture of the body of the fibula are, to dress properly the contusions and the wounds which may perhaps attend the fracture. The bone generally unites in from thirty to thirty-five days, and the limb is usually straight.

*History.* But fractures of the malleolar portion of the bone to which we shall now attend are much more dangerous and more serious. For a long time they were confounded with dislocations of the foot. They were first mentioned by J. L. Petit and Duverney, among modern surgeons. Petit particularly remarked, that lateral dislocations of the tibio-tarsal articulations could not occur without the rupture of one of the malleoli. David, Fabre, Broomfield, Pott, Pouteau, Boyer, and Ch. Bell, have since contributed by their remarks, to make us better acquainted with fractures of the lower extremity of the fibula. The history of these injuries, however, was still very imperfect, and the mode of treatment seldom prevented deformity, when M. Dupuytren thought of the subject, and rendered the treatment of this as efficacious as that of other fractures.

*Causes.* The lower extremity of the fibula may be broken either by direct causes like those mentioned above, or from efforts

upon the foot, which produce their effect by a counterblow. The mechanism of fractures of the first kind, continued the professor, presents nothing remarkable: that of the second, on the contrary, demands the attention of the practitioner, because it is important to know perfectly the circumstances capable of fracturing the fibula, in order to be acquainted, in doubtful cases, with the possibility of the existence of this injury. A clod, a cavity, or simply an inequality of the soil, a fall from a height on the feet inclined inward or outward, these are the most common causes of these fractures: they result directly from the action of the weight of the body and the contraction of the muscles acting quickly on the lower articulation of the leg, at the moment when the foot is carried inward or outward, and separated from the vertical line.

Let us now see by what mechanism fractures of the fibula may be caused by violent motions of the foot inward or outward. It is evident that in these two cases there is a change in the line of the support of the weight of the body, which causes the fracture. In the first case this line, instead of passing through the axis of the tibia as it does generally, and falling on the astragalus, cuts obliquely from within outward the lower extremity of the tibia, the articulation of the foot, and extends to the outside of this limb, after passing through the malleolus of the fibula. The parts upon which the weight of the body falls are then the external malleolus or the lower extremity of the fibula, which yields to the traction of the external lateral ligaments; this traction is much more powerful, as the direction of these ligaments is then almost perpendicular to the malleolus, and as this process rests on the sharp edge of the astragalus, which is also pushed forcibly from within outward by the tibia. This last bone is thicker and stronger than the fibula and usually resists, and if its malleolus be sometimes broken and afterwards wrenched, this fracture does not occur primitively, but this malleolus, and sometimes the lower extremity of the tibia, are fractured consecutively, and from the displacement of the foot outward.

In the second case, that is, in the motions of the foot outward, the centre of gravity of the body, instead of following the line by which it is generally transmitted to this limb, and thence to the soil, passes obliquely through the lower part of the fibula, the articulation of the foot, the malleolus or the internal lateral ligaments, and falls on the ground more or less distant from the inner edge of the foot. These ligaments, and the malleolus to which they are partially attached, on one part, and the lower extremity of the fibula on the other part, are then the parts which must support the weight of the body and the efforts of the muscles: these also are torn or fractured: first the lateral ligaments or the internal malleolus, and then the lower extremity of the fibula.

*Signs.* Two orders of signs mark the compound affection of which we are now treating: some belong to the fracture of the fibula, others to the dislocation of the foot: a difference which is abstract, since fracture of the fibula may exist sometimes without dislocation of the foot.

These symptoms are of two kinds, presumptive and characteristic. The presumptive signs, said M. Dupuytren, are the species of accident which happened to the patient; a noise, a kind of cracking heard at the same moment, a constant pain in the lower part of the fibula, difficulty of walking, or even an inability to walk, a greater or less swelling around the articulation of the foot, and particularly around the external malleolus and the lower extremity of the fibula. The characteristic signs are, an unevenness, an unnatural motion in some part of the lower extremity of the fibula, a more or less evident crepitation from motion or pressure, a cross motion of the foot, the ease with which the lower extremity of the fibula can be made to approach the tibia by pushing it, the change in the direction of the axis of the leg on the foot, the displacement of this latter outward, inward, and sometimes backward, the rotation on its axis from within outward, a more or less marked angular depression at the lower and outer part of the leg, the prominence of the internal malleolus, the disappearance of nearly all these symptoms as



soon as we attempt to reduce the foot, and their instant return when these efforts are suspended, and especially when the limb is extended.

Let us now review these signs in detail, and attend particularly to the characteristic symptoms. The fibula is no sooner fractured, than very remarkable phenomena supervene in the tibio-tarsal articulation. The outside of the groove which receives the astragalus, having lost its solidity, no longer resists so strongly the action of those muscles which tend to turn the foot outward, and which are more powerful than their antagonists. The outer edge of the foot then rises, the inner edge is depressed, the dorsal face of the part looks directly upward, and the plantar region is inclined outward. The pulley of the astragalus is directed on the internal malleolus, and sometimes causes a prominence there, which is easily discovered through the integuments: the malleolus of the fibula, on the contrary, has a see-saw motion on the tibia, which raises its summit, and brings the upper extremity of the fragment, near the axis of the limb. The foot is then placed on the outside of the centre of the intermalleolar space: if we extend the axis of the tibia downward, it would fall on the inside of the tarsus, and the weight of the body would be supported by the internal malleolus, and the ligaments attached to it. This displacement of the foot outwards, is the only one necessarily resulting from the fracture of the fibula: and it is the more marked, the lower the fracture, and the more the patient has tried to use the broken limb. Where the fracture is caused by the violent inclination of the foot inward, the action of the muscles soon brings the foot outward, and produces in its relations with the leg the changes mentioned.

If the fracture of the lower part of the fibula is not recognized, or is treated inefficiently, the derangements produced by it become still greater, the action of the muscles gradually draws the foot outward, the astragalus is brought above the internal malleolus, the corresponding ligaments are extended, the distended soft parts inflame and alter, and the synovial capsule being open, caries attacks the articular extremities, and destroys them. In the most favorable cases, the patients, being unable

to confide the weight of the body to a deformed, weakened, and painful limb, the extremity of which is the malleolus of the tibia and the inside of the foot, are compelled either to use crutches, or to walk with a wooden leg. M. Dupuytren has amassed a great number of facts, which show the fatal results which attend fractures of the fibula when they have not been recognized.

It is important, then, to determine correctly the diagnosis of these injuries. Whenever an accident which may produce them, has happened, we should carefully examine the lower part of the leg, and the tibio-tarsal articulation. The presumptive signs may doubtless be caused simply by twisting the foot, or when this is attended with rupture of the ligaments: but collaterally they may render the existence of the simple fracture probable. If there be dislocation, we can almost always discover in the part the inequalities produced by the fragments, which are proportional to the extent of the dislocation. In passing with the finger over the whole lower portion of the fibula, we perceive at the fractured part an abnormal mobility, which must be distinguished from the elastic flexibility of the bone, and the existence of which is demonstrated by embracing the tibia with the four fingers of each hand, while we press the fractured parts successively with the thumbs. The crepitation is commonly slight, and frequently cannot be perceived. If we grasp the lower part of the leg with one hand, and the tarsus with the other, if the fibula be fractured, the whole of the foot may be carried alternately inward and outward.

The last motion renders the internal malleolus prominent, separates from the centre of the joint the external malleolus, and removes in a measure the astragalus from the line of the axis of the weight of the body: the other restores all these parts to their natural state. If left to itself, the foot, as we have said above, is inclined outward: the internal malleolus projects considerably: the integuments which cover it are tense and strained, the axis of the leg falls on the inside of the tarsus, instead of corresponding to its centre: the space between the two malleoli is enlarged; on the outside of the joint, the skin is wrinkled transversely: the external malleolus seems pressed down; above and

in the fractured part, we commonly observe a sharp depression, the direction of which is before backward, a kind of hatchet cut, as M. Dupuytren terms it, which becomes a pathognomonic sign of the fracture of the bone. This, however, must not be confounded with the depression presented by the fibula above the malleolus, and between the tendons of the peroneus brevis and tertius muscles.

In some patients, the wounding force turns the foot inward so forcibly, that it remains there, notwithstanding the fracture of the fibula: but the upper extremity of the lower fragment then raises and nearly tears the skin: the finger perceives the unevenness of the fracture. After the dislocation is reduced, the phenomena mentioned above appear, and the accident cannot be mistaken. The last symptom is the ease with which all the symptoms reappear, after they have been removed by restoring the foot to its normal direction.

The prognosis of fractures of the lower part of the fibula should be serious, in proportion to the derangement attending them. When simple, and discovered immediately, and treated methodically, they are seldom attended with bad symptoms or with deformity. They become dangerous only when overlooked through the ignorance of the surgeon, or when they are treated unskillfully.

*Species and complications.* Fractures of the fibula are divided by the professor into simple and complex. The fracture is simple, when there is a fracture of the bone, and no other derangement. This form is extremely rare. It cannot occur, except at a certain distance from the lower extremity of the fibula, and when the cause which has produced it immediately ceased to act, and has been unable to produce other effects, or still more when another cause consecutive to the first has not occasioned other injuries.

It is very difficult to discover a simple fracture of the fibula. We can have in regard to its existence only the presumptive signs mentioned above.

One of the most common causes why this kind of fracture is seen so seldom, is certainly the exertions made by the patients,

directly after the accident, either to walk home or to some adjacent place. Sometimes it has been known to lose its primitive character of simplicity long after the accident, from the imprudence of the patients, who tired of being still, have wished to walk by supporting themselves on the fractured limb. Hence we can imagine how important it is, in cases of this kind, to oblige them to keep perfectly still. This rest and some resolvent applications, are generally sufficient to produce a perfect cure. This kind of fracture presents two varieties. In the first the fibula is fractured more than three inches from the summit of the external malleolus. This is distinguished from all other fractures, inasmuch as the foot is not and cannot be dislocated. This impossibility depends particularly on the length of the lower fragment of the bone, and on the integrity of the tibio-peroneal ligaments. It is generally found in fractures produced by a direct cause, and never in those which occur indirectly. The reason of this is that the latter is always preceded with a more violent motion, and even with a dislocation of the foot either inward or outward. This variety is never dangerous, and in order to be cured, only requires rest, and that the limb should be kept semiflexed. The second variety embraces all cases where the fibula has been broken directly or indirectly at least three inches from the top of the external malleolus, and the foot is not dislocated. It may occur in any intermediate points, but when the foot has been forcibly thrown outward, it generally occurs two and a half inches from the top of the malleolus, because the fibula is weaker and thinner in this part than in any other, and being curved inward by the weight of the body and the action of the muscles, it presents less resistance. If on the contrary the foot had been flexed inward, the fracture generally occurs below this part, and in that portion of the bone which is lodged in the groove of the tibia. This variety is particularly distinguished from the preceding, by the degree of facility with which the foot may be displaced.

The *complications* of fracture of the fibula are numerous, and render it more serious than it is of itself. If any cause, for instance, produces a violent motion of the foot outward, the efforts

of extension and of flexion which fracture the fibula, act first on the soft parts of the inner face of the articulation and the lower extremity of the bone, rupture the internal lateral ligaments, and cause the dislocation or even the fracture of the internal malleolus: or, as the fracture is caused by the motion of the foot inward, and the individual has afterwards attempted to walk and to rest on the foot, the latter will be carried outward, and the same symptoms will occur. Hence a first complication. Sometimes the lower extremity of the tibia is broken, instead of the lateral ligaments and the internal malleolus. This fracture, whether preceded or followed with that of the fibula, is almost always oblique and attended with dislocation of the foot. A third complication which occurs generally, except in cases of simple fracture, which as we have already mentioned are extremely rare, is the dislocation of the foot. This happens in different directions, inward, backward, outward, and finally outward and upward. The first is so common and is so connected with the existence of fracture of the fibula, that one rarely exists without the other, and it is one of the most certain symptoms of fracture: it consists in the displacement of the head of the astragalus, which is thrown below and on the inside of the malleolus of the tibia; this displacement is only the continued effect of the action of the causes which produced the fracture, or rather a consequence of the action of the abductor muscles of the foot.

The second arises from the action of the gastrocnemii and soleus muscles: the latter act on the foot, which is no longer retained in place by the resistance of the external malleolus, and cause the astragalus to glide from before backward on the lower extremity of the tibia, and the lower end of the fibula to move so that its lower extremity is carried backward, while the other is carried forward.

The third kind of luxation is the rarest and most difficult to explain. The astragalus is then carried from the side and below the peroneal malleolus, while the outer edge of the foot is carried downward, the sole inward, and its inner edge upward: the malleolus of the tibia is concealed and disappears between the foot and the leg, at the base of a re-entering angle on the inside,

and the fibular malleolus forms with the astragalus a prominent angle which is rounded outwards. According to these arrangements of the parts, the foot presents the appearance of a congenital club foot. The professor attempting to account for the cause of this extraordinary displacement, examined successively the organization of the lower extremity of the limb, the relative action of the antagonist and balancing powers which govern it, and their effects. First, in a state of rest and of sleep, in club-footed people, and in most false steps and sprains which result from it, the foot being constantly directed inward and the astragalus carried outward, these parts seem to be displaced almost always in the same direction from fractures of the fibula and the lower extremity of the tibia: and it follows also, from the study of the respective powers of their antagonist muscles, that in most cases the abductors should be, and are in fact more powerful than the adductors: hence we remark, that the outer edge of the foot is generally drawn outward, and the astragalus inward, whether there be a fracture of the malleolus and the lower extremity of the fibula, or of the two malleoli at the same height: finally, when the tibia alone is fractured at its extremity, although the foot has no longer any support on the inside, and preserves on the contrary that which the fibula and malleolus supply to it, nevertheless the astragalus is most generally more or less evidently displaced inward, which cannot be attributed except to this superiority of the abductors over their antagonist. From all these considerations, said the professor, we must necessarily conclude that the dislocation of the foot outwards, (in which the astragalus is carried outward and the foot inwards) cannot arise, except from peculiar, unusual, and very rare arrangements. Reason and observation have taught him, that these arrangements consist in the obliquity of the fracture of the tibia, and in the greater or less resistance of the lower fragment of the fibula, the obliquity of the first, influencing the direction in which this displacement is made and the muscles which produce it: the resistance of the second, preventing the foot from going outward, and consequently favoring the action of the abductors.

The last kind of dislocation of the foot, outward and upward, which has never been mentioned, has been seen but once by M. Dupuytren in twenty-five years practice, and in more than two hundred cases of fracture of the fibula which he has treated. But it has been characterized in such a manner, that its possibility cannot be doubted, nor can it be mistaken: in this species, the astragalus is at first dislocated outward, and then ascends on the outer face of the tibia. In the instance mentioned by the professor, the astragalus, the external malleolus and the foot, were carried first on the outside of the leg, and were then raised in an entire mass two inches along the tibia, as in the natural state of parts firmly articulated with each other. We can then imagine that it will not occur without fracture of the fibula and complete laceration of the tibio-peroneal ligaments.

If the fibula be fractured in several parts and in several directions at once, which happens particularly when it has been crushed by a violent blow, or by the passage of the wheel of a vehicle over the lower and outer part of the leg, there is a laceration and destruction of the soft parts, the nerves, tendons, aponeuroses, and the skin, and consequently, the patient is affected with pain, inflammation, abscesses, eschars, convulsive motions, tetanic spasms, &c., which actually endanger his life, and render the treatment long and difficult.

But although this species of complication is very serious, it is not to be compared with that frequently caused by internal derangements which are concealed from the sight by the skin. These are sometimes so great, that we should almost despair of relieving them, had not experience taught that they may be cured perfectly, completely, and in a little time. Thus the tibia and fibula are fractured singly or together, in one or more parts, with numerous sharp cutting spiculae depressed into the flesh; the articulation may be opened and its cavity filled with blood mixed with synovia: the internal lateral, the tibio-peroneal, and the external lateral ligaments may be ruptured unevenly: the tendinous grooves of the muscles may be open: the tendons and the nerves distended, twisted, compressed, displaced, and partially or entirely divided: the arteries and the veins, par-

ticularly the internal saphena vein, compressed, ruptured, and surrounded by effused blood: the cellular tissue may be torn in every direction and filled with reddish serum, and more frequently also with blood which is infiltrated to the toes below, and to the knees above. If we add to these accidents the various displacements, to which the bones are exposed, we shall have a slight picture of the disorders which so frequently attend fractures of this kind.

The arteries or veins may be injured alone, and independent of the formidable injuries mentioned above, and may give rise to an infiltration of blood into the meshes of the cellular tissue, or to an effusion of this fluid into sacs of various sizes, formed from the ruptured cellular tissue, which separate the soft parts, surround the fragments of the bones, extend around the articulation, and sometimes penetrate within it. This kind of injury constitutes a new species of complication, and further, one of the most common of fractures generally, and especially of those of the fibula; it deserves to be particularly distinguished on account of the severe symptoms it causes, and the proper mode of treating it.

Very commonly the skin has been removed and lacerated in one or more places by the ends of the fractured bone: these openings are generally irregular, with ragged, torn, and disorganized edges; sometimes they embrace the bone, sometimes they are open and give passage to blackish blood, or folds of flesh and half destroyed tendons project from them. They are produced in several ways, either primitively as we have mentioned, or consecutively from inflammations, from the removal of eschars, from a process of elimination established by nature to expel the blood, the pus, and all other disorganized parts. These lesions of the integuments are another kind of complication so serious in its effects, said the professor, that fractures which are otherwise not very severe, may become extremely dangerous, although we ought never to despair of the cure of these internal injuries, however, extensive they may be, provided the skin is sound. Those produced directly by the fracture are the most dangerous, on account of the violent consecutive inflammation,



and the pains, abscesses and necroses, and numerous other symptoms which result from the formation and infiltration of pus.

The swelling, tension and strangulation which follow fractures are different degrees of the same complication, and the result of the fluxion made upon the nervous and fibrous parts which are distended or lacerated by the bones, and the displacements which they have undergone. When these symptoms are not discussed at the commencement, the tumefaction and the swelling may become very intense and dangerous in a few hours: here and there are phlyctenae filled with reddish serum; the limb becomes livid, cold and insensible, and if the disease be not arrested at this period, strangulation takes place: the extreme distention of the external parts and the no less violent compression of the internal parts cause gangrene, and a part or the whole of the limb mortifies. These phenomena are perfectly developed before any marks of inflammation are seen, which circumstance doubtless depends on the rapidity with which it takes place. But in other cases, the fluxion mentioned above is followed with inflammation, which then assumes two different forms: sometimes the symptoms progressively increase: the pain, redness, heat, tumefaction and tension, the local and general fever, exist in the greatest degree, and are followed as in the preceding case with numbness, lividity and icy coldness of the limb, with cessation of pain, which pleases those who are ignorant of the cause, and with gangrene. The skin, or the cellular tissue, tendons, nerves, ligaments, and sometimes the whole foot, mortify. Sometimes this inflammation appears in the form of a slight phlegmonous erysipelas, the progress of which is slow: but after a few days, the symptoms increase, the fever becomes intense, the tongue dry, diarrhea supervenes: we soon begin to perceive here and there an obscure fluctuation, the crepitation of elastic fluids: we remark phlyctenae: under them form eschars which open, and a mixture of pus and elastic fluid is discharged. The subcutaneous cellular tissue mortifies: the skin peels off in a greater or less extent; a slow fever exists, the strength fails, and the patient exhausted by the fever, by the suppuration, or the diarrhea, dies in a greater or less length of time.

The displacement of the bones, the wound, the laceration, and the distention of the parts, cause, and keep up a permanent secondary pain, which is increased by the inflammation and its attendant symptoms, is accompanied with fever, watchfulness, agitation, and may, by its intensity, or from the peculiar sensibility of the patient, or on account of his constitution, cause even convulsions and tetanus. The former symptoms generally disappear as if by magic, as soon as the fracture is reduced; according to the old adage, *sublata causa*, &c. But the tetanus, when once manifested, resists the most energetical treatment, and amputation even rarely arrests its effects. One complication of fractures of the fibula, and of surgical diseases generally, is too common and too important to be passed over in silence: we allude to *nervous delirium*. We have devoted an article, the eleventh, exclusively to this affection.

If from the effect of the laceration or the destruction of the flesh, the bone is exposed directly to the air, or if the inflammation and the suppuration have destroyed the vitality of the spiculae, or have detached from them the periosteum which nourishes them, these speculae die, and hence necrosis of these bones, another complication of fractures of the fibula. Nevertheless, this necrosis of the fragments of the fractured fibula is rare, but on the contrary, very common in the tendons of the lower extremity of the leg. It is because the tendons are also more exposed to the disorders produced by the fractures. It does not manifest itself immediately; but some time after:—Then appear pain, redness, heat, swelling, tension, and an obscure fluctuation in the course of the affected tendons: the skin becomes thinner and opens: pus escapes through these openings, filaments come from it, and are replaced until every part destroyed by the necrosis has been removed. Finally, a last and frequent complication of fractures of the fibula, when they are followed by inflammation, is an adynamic affection, which according as it is true or false, essential or symptomatic, requires such a different course of treatment, that the patient's life frequently depends on the proper distinction being made.

*Treatment.* Perhaps there is no surgical disease, the treatment

of which has hitherto been more uncertain and generally more inefficacious, than that of fractures of the fibula, attended with dislocation of the foot. There is, however, no one which, on account of its frequency and the severity of the symptoms attending it, requires more imperiously a determinate mode of treatment, certain in its results, and founded on principles sanctioned by experience. This defect in the treatment depended on two causes; one which we shall call theoretical, may be ascribed to the imperfect ideas on the respective arrangement and uses of the great number of organs which form the lower extremity of the limb, and on the mechanism of the causes which produce this fracture and this dislocation. The second, which may be considered as a consequence of the first, was the imperfection of the modes of reduction and especially of the apparatus used to keep the reduced parts in perfect relation with each other. In fact, if we compare the old methods with the mode of action of the moving powers of the limb, we shall see that none of these methods is capable of keeping the reduction perfect. Pott, the only surgeon before M. Dupuytren who has stated the manner of reducing it easily and without efforts, has indicated no mode of continuing the reduction. The number of failures resulting from the preceding causes, was also greatly increased by the erroneous opinions on the mode of reduction according to the nature of the complication. M. Dupuytren has re-modelled this theory, has established the gentle and easy process of Pott for the reduction on its true basis, and invented a method as certain in its effects as it is precious in its results, for keeping the reduced parts in their exact relations until they are firmly united. This was the foundation, the greatest difficulty to be conquered, and in which no one before him had completely succeeded. We shall see by explaining his mode of treatment and the results of his practice, how much the science owes to this celebrated surgeon, and what immense services he has rendered to humanity.

*Cure.* If we consider the fracture in itself and abstractly, the first and only indication to be fulfilled is, to prevent all displacement of the fragments. Rest and immobility will frequently

accomplish this, and produce a cure whenever there is a simple fracture, whether it occurs at more or less than three inches from the lower end of the fibula. These modes, added to the reduction, will also be sufficient if the fracture be complicated with a simple dislocation of the foot, in whatever direction it may occur; and they should be immediately used, if we wish to prevent the accidents and deformities which result from them. But there was a question which it was important to solve, because the safety of the patients depends, in a great many cases, on the manner in which it is considered. Is there any complication of fracture of the fibula, which contra-indicates its reduction? All the symptoms which we have mentioned above are the immediate effects of the powers which have produced the fracture, or the consecutive effect of the fracture itself. M. Dupuytren proceeds on this principle, which conforms to the nature of things and to observation, viz.: that in both cases, the symptoms are aggravated and become more intense by the cause which has produced them, and that they must become more serious the longer this cause acts; he therefore admits, as a general rule, that the surest and quickest mode of arresting them is to reduce the parts at all periods of the disease. This was also the opinion of Desault, who reduced the parts when the most violent inflammatory symptoms existed, but the apparatus which he employed for the dressing cannot be proposed as a model.

*Reduction.* There is no reduction, said M. Dupuytren, which can be accomplished more easily than that of fractures of the fibula attended with dislocation of the foot, when we have discovered the mode of overcoming the resistance of the muscles. The obstacles arising from this resistance, have exercised the talents of surgeons from Hippocrates to our days. In order to attain this, we have merely to flex the leg on the thigh, and distract the attention of the patient. The muscles soon lose their tension, the resistance ceases as if by enchantment, and the parts resume their natural situation and relations almost without effort. However exact the reduction performed in this manner may be, it is always imperfect, the fragments of the bone remain depressed on the side of the tibia, the foot tends con-

tinually to yield to the action of the peronei muscles and to go outward. We must then require some mode to raise the fragments, separate them from the tibia, and place them nearly opposite each other. What is this mode? It is impossible to act on the upper fragment which is never depressed, and which, on the contrary, is generally prominent: hence we must act on the lower, and consequently through the medium of the foot; now the latter is connected with the malleoli so intimately, that when it is drawn forcibly on one side, one of them is crowded upward, and the other drawn downward in the same proportion. Hence we conceive that the lower fragment of the fibula may be raised by pulling it obliquely, that is, by exercising upon the foot forcibly the motion of adduction. The external lateral ligaments being unable to extend except to a certain point, act upon this fragment more forcibly, the more the inner edge of the foot is carried inward. In this manner, the lower extremity of the tibia is depressed deeply in the joint, the astragalus is pushed from within outward, the lower fragment of the fibula has a see-saw motion upon it in a contrary direction to that of its displacement, and thus resumes its position under the upper fragment.

*Mode of keeping the parts reduced.* It is evident that the position which rendered the reduction of the fracture so easy, by relaxing the muscles, is also the first mode to be used to keep the parts reduced. But we can imagine it would be imprudent thus to leave a fractured limb to itself, and that the bones must be kept together by a dressing until the callus has formed and become solid. This dressing should be modified more or less, according to the kind of dislocation attending the fracture.

A cushion, a splint, and two bandages compose all which M. Dupuytren has used so successfully for more than twenty-five years, in fracture of the fibula attended with dislocation inward. The cushion is made of cloth and two-thirds filled with straw: it should be two and a half feet long, four or five inches broad, and three or four thick. The splint should be from eighteen to twenty inches long, two and a half inches broad, and from three to four lines thick, and should be made of thick

and stiff wood. Finally, the two bandages should be made of worn linen, and should be from four to five ells long.

The cushion, folded in the form of a wedge, is applied to the inside of the fractured limb and extended on the tibia, its base directed downward and resting on the internal malleolus, but not extending beyond it, its summit upward, and on the inner condyle of the tibia. The splint applied along the cushion must pass five or six inches below it, and extend three or four inches below the inner edge of the foot. These first parts of the dressing should be attached to the upper part of the leg, by a few turns in the bandage directed from above downward.

In this state, the splint is extended beyond the base of the cushion, and leaves between it and the foot a space equal to the thickness of the cushion, that is, from three to four inches: this extremity of the splint will serve as a point of support to bring the foot from without inward. In order to do this, we attach to it the end of a second band, which is then carried successively from the splint to the upper face of the foot, to its outer edge, under the sole, on the splint, then from this on the ankle and under the heel, then again on the splint, which is continued in the same manner until the whole bandage is used. By thus embracing within the same turns of bandage, which it shortened at pleasure, the splint and the heel alternately, the foot is placed in such a state of adduction that its outer edge becomes the lower, the sole is directed inward, and its inner edge looks upward. But as the foot yields to the action of this apparatus, the tibia pressed by the base of the wedge formed by the cushion, and on which the whole apparatus is supported, is pushed outward, as is also the astragalus. The lower fragment of the fibula being carried upward by the tibia and downward by the external lateral ligaments, has a see-saw motion on the outer edge of the astragalus, as we have already mentioned, by which it is brought to its natural situation. The professor remarked that if we wish the reduction to be complete, we must not merely bring the foot under the leg, but continuing the efforts at reduction, the dressing should bring it as much inward, as it was carried outward by the fracture.

This apparatus, besides the advantage of reducing the parts without effort and almost without pain, and of keeping them reduced, presents another, which is of great value. It leaves between the bandages a considerable space, where we can see the articulation and the fractured part, and can apply all the topical remedies, which the primitive or consecutive complications may require.

The same apparatus is also suitable in all cases of fractures, with simple *dislocation* of the foot *outward*. In order that it may be applied to a *dislocation outward and upward*, it must be placed on the outside, that is, along the fibula, instead of inside or along the tibia.

But cases of *dislocation backward* present many more difficulties than the preceding, both in reducing the parts, and in keeping them reduced. In the first case, the difficulties arise from the resistance of the muscles to the lengthening of the parts, and the re-establishment of their natural relations: in the second case, the upper face of the astragalus, which is convex from behind forward, is so slippery, that it is very difficult for the tibia to rest evenly upon the pulley of this bone, and it tends constantly to go forward, while the astragalus being continually acted upon by the extensor muscles of the foot, which are more powerful than the flexors, tends continually to go behind the lower extremity of the tibia. This double action must be resisted, if we wish to cure the patient without deformity. We owe to M. Dupuytren the discovery of a mode of treating this fracture, which consists simply in a modification of the apparatus we have described, and its mode of applying it.

To the parts enumerated, we add a small cushion a few inches square, filled with hair or straw. The large cushion, also, is folded in a wedge form, and laid on the posterior parts of the leg, and extended from the heel to the calf of the leg, its base downward, and summit upward. On this cushion, we apply the splint, which is attached by a band to the upper part of the leg; a second band embraces the lower extremity of the leg and of the splint: this is the active part of the apparatus. The small cushion is destined to cover the tibia, to keep it from being com-

pressed by the bandage. The latter, in resting on the splint and the tibia, carried the heel forward, and the tibia backward, by the same effort. The power of this mode is such, that we have to fear it may be too great.

Fractures complicated with dislocation of the foot inward and backward, are most generally cured by the treatment of that of the two displacements which predominates. In the contrary case, it is easy to combine the two apparatuses which we have described, so as to fulfil this double indication.

(Here follow details of seven cases of various types of fractures of the fibula.)

*Effects of M. Dupuytren's mode of treatment.* 1. The first and most important effect, of which all the others are but in some measure the consequence, is the return of the foot into its situation, and its natural relations with the leg: 2. The second, which is no less important, consists in reducing the fractured fragments so exactly, that notwithstanding the extent of the displacement of the parts but few cases show, when the treatment is terminated, the slightest trace of the accident or of the deformities produced by it: 3. The third is the almost sudden and instant cessation of the racking pains caused by the displacement and the straining of the parts: 4. The fourth is the very rapid diminution of the swelling, tension, and strangulation, which have supervened around the articulation of the foot: 5. The fifth, finally, is the removal of all the causes which may produce secondary symptoms. In fact, it prevents spasms, involuntary contractions and tetanus: inflammations and suppurations are much more rare, and in all cases are but slightly dangerous; it prevents the appearance of gangrene: the infiltrated or effused blood is easily absorbed: the lacerations of the skin are less serious and cicatrize like ordinary wounds: the internal injuries can be repaired, and the parts affected with necrosis can be exfoliated: finally, this method of treatment, if insufficient to arrest these consequences, removes their danger.

*General results.* The duration of the treatment, that is, of the application of the apparatus, is generally from twenty-five to thirty-five days in simple fractures, and in most of those attended



with dislocation inward, outward or backward, with infiltration or effusion of blood, with the laceration of the lateral ligaments from the summit or the base of the internal malleolus: from forty to sixty days, for those complicated with serious derangements in the soft parts, whether internal or external, with inflammation, suppuration, abscesses, &c.; from sixty to eighty, or one hundred days, and even longer in comminuted fractures, complicated with numerous spiculae; and consequently with necrosis of the tendons and bones.

The convalescence is generally twice as long as the treatment, whatever may be the kind of fracture.

In all cases, the foot seems carried more or less inward, that is, in the sense of adduction, after the apparatus is removed. But the action of the muscles, or according to circumstances, the application of the apparatus on the outside will restore the foot to its natural position, the former in a few days, and the latter in a few hours.

Of two hundred and seven patients treated by M. Dupuytren's method, two hundred and two have been cured; five only have died, three from symptoms dependent on the disease, and two from complications independent of it.

In all patients who were cured, the limb has preserved its form, except in two cases, when the heel extended a little backward, and the lower extremity of the tibia projected slightly forward.

All have recovered the free use of the motions of the foot; in only one there was an ankylosis of this with the leg.

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SIR WILLIAM OSLER, BT., M.D., F.R.S.

From the portrait painted in 1908 at Paris by Seymour Thomas, Esq. Reproduced with the kind permission of Dr. Maude E. Abbott from her *Classified and Annotated Bibliography of Sir William Osler's Publications*. 2 ed., Montreal, McGill University, 1939

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## Sir William Osler

### BIOGRAPHY

- 1849 Born July 12, at Bondhead, Ontario, Canada, of Celtic stock, son of a minister of religion. Early intended to become a clergyman, but became interested in natural science and resolved to study medicine.
- 1866 Age 17. Entered Trinity College School at Weston.
- 1870 Age 21. Entered Toronto School of Medicine.
- 1872 Age 23. Received M.D. degree from McGill University. Went abroad to study, in London for fifteen months, thence to Berlin and Vienna.
- 1873 Age 24. Did early work on the blood-platelets.
- 1874 Age 25. Returned to Canada and soon became Lecturer on the Institutes of Medicine at McGill University.
- 1875 Age 26. Became Professor at McGill University.
- 1876 Age 27. Became Pathologist to the Montreal General Hospital.
- 1884 Age 35. Appointed Professor of Clinical Medicine at the University of Pennsylvania.
- 1889 Age 40. Became Professor of Medicine at the Johns Hopkins University, "where he did most to develop the scientific teaching of internal medicine in the hospital wards."
- 1892 Age 43. Published first edition of *Principles and Practice of Medicine*.
- 1893 Age 44. At the opening of the Johns Hopkins Medical School, Osler was surrounded by such men as Abel, Halsted, Kelly, Wall and Welch.

- 1895 Age 46. Described the visceral complications of erythema multiforme.
- 1901 Age 52. Described a form of multiple telangiectasis.
- 1903 Age 54. Described chronic cyanosis with polycythemia and enlarged spleen.
- 1904 Age 55. Appointed Regius Professor of Medicine at the University of Oxford.
- 1908 Age 59. Described erythematous swellings in malignant endocarditis (Osler's spots).
- 1917 Age 68. Received a hard blow when his only son, Revere Osler, was killed in battle at Ypres, France.
- 1919 Age 70. Died, December 20, at Oxford of septic pleurisy. Ashes returned, with his vast medical library, to McGill University.

"When he came to die, Osler was, in a very real sense, the greatest physician of our time. He was one of Nature's chosen. Good looks, distinction, blithe, benignant manners, a sunbright personality, radiant with kind feeling and good will toward his fellow men, an Apollonian poise, swiftness and surety of thought and speech, every gift of the gods was his; and to these were added careful training, unsurpassed clinical ability, the widest knowledge of his subject, the deepest interest in everything human, and a serene hold upon his fellows that was as a seal set upon them. His enthusiasm for his calling was boundless." Garrison's *History of Medicine*, 4 ed., p. 631.

## INTRODUCTION

The writings of Sir William Osler need no introduction to medical readers. No disciple of Aesculapius has had as vast an audience or as wide an influence as this Master. He has been known to every medical student of the past forty years for his text book on medicine as well as for his medico-historical and philosophical writings. In contrast to this well known Oslerian literature, the early scientific writings of Osler are not as well known. So much emphasis has been placed on Osler's later work and his far-reaching influence as a clinical teacher and stimulator, that the scientific work and writings which he did in his early days have been overshadowed. It is this neglect which we are attempting to correct in reprinting selections from the writings of Sir William Osler.

At the early age of twenty-four, one year after graduating from McGill University, Osler began his work on the study of blood platelets. This work was of a pioneer nature and was brought to a successful conclusion as described in his Cartwright Lectures, *On certain problems in the physiology of the blood corpuscles*, published in 1886. These lectures are reproduced here in their entirety.

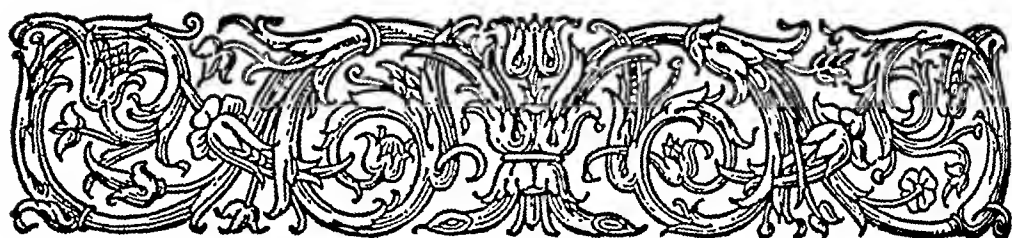
In this volume is also included Osler's paper of 1897, *A clinical lecture on the ball-valve gall-stone in the common duct*.

Osler's name is today attached to a syndrome, Rendu-Osler-Weber's disease, so it is fitting that Osler's first paper on that condition should be included herein. His papers, *Chronic cyanosis, with polycythemia and enlarged spleen: a new clinical entity*, of 1903 and *On multiple hereditary telangiectases with recurring hemorrhages*, of 1907 are also republished in this number.

It is desirable that the generation of doctors which is now growing up, young men who were never privileged to see or hear or to catch the magnetic spark of his personality, should know the important early scientific work which this master physician did and recognize the groundwork on which his subsequent professional reputation was founded. Truly these papers and this man are a fitting addition to MEDICAL CLASSICS.

Doctor Maude Abbott has done such a fine piece of work in her latest contribution, *Classified and annotated bibliography of Sir William Osler's publications*, 2nd ed., Montreal, McGill University, 1939, that any medical student or physician will gain a great deal of information by a study of her work. Because the material is readily available, no bibliography is included in this number.





# On Certain Problems in the Physiology of the Blood Corpuscles

Cartwright Lectures

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## LECTURE I

### THE BLOOD PLAQUE

**I**NTRODUCTION.—Around the blood corpuscles still centre some of the most interesting questions in physiology and pathology, and though amid microbes and cultures we may have forgotten them for the moment, they are nevertheless still calling for solution, and perplexing this quite as much as any of the six or seven generations which have passed away since Loeuwenhoek first detected the red corpuscles in the human blood.

The origin and life history of the corpuscles of the blood have been, and still are, among the great secrets of physiology. Strange indeed, is it to think of the thousands of able observers who have gazed long and ardently, with rude and with perfect instruments, vainly endeavoring to solve the riddle constantly propounded by these common objects of study. In no department of phys-

iology has so much labor been spent with so little apparent result. While in other lines we have penetrated to the centre of certain biological mysteries, the progress here seems painfully slow, and the discovery by Wharton Jones, in 1846, of the amoeboid power of the colorless corpuscles, the rediscovery by Cohnheim of their migratory power, and the discovery of the blood-forming function of the marrow, may be said to be the most important additions to our knowledge in this generation.

The activity of research during the past decade has had, however, a perceptible influence, and there are signs of breaking in the heavy clouds which overhang the origin of these corpuscles, and the darkness is certainly less dense than it was.

A peculiarity of these perennial problems is that certain phases for the time engage the attention of observers, and the laboratory activity the world over seems centred upon them, with the result, in a few years, of an enormous increase in the literature, and after the question has been thoroughly fought out and quiet is resumed, we are thankful if only an outpost has been gained in the struggle and we are a step nearer to the citadel of truth.

As regards the blood corpuscles, the work of the past few years has been largely in two directions—toward the determination of the existence or non-existence of a third corpuscle in the blood, and in the study of the histological processes attending degeneration and regeneration of the corpuscles in disease, and upon these subjects I shall hope to engage your attention during this course.

I propose, therefore, in the first lecture to consider the much debated third corpuscle, or haematoblast of Hayem, which, so far as I know, has not yet received systematic consideration before any American or English audience. In the second I shall discuss certain histological problems connected with the degeneration and regeneration of the blood corpuscles; and in the third I shall present a statement of recent views on the relation of the corpuscles to coagulation.

## THE THIRD CORPUSCLE OR BLOOD PLAQUE

*Definition.*—A colorless protoplasmic disk, constant in mammalian blood, measuring from 1.5 to 3.5 micromillimetres. The number per cubic millimetre in the blood of a healthy adult is

about 250,000, but their number varies greatly at different periods of life and with varying conditions of health and disease. The ratio to the red is about 1 to 18 or 20. They are delicate elements, and, like the red corpuscles, tend on the withdrawal of the blood to adhere to one another, when they form the irregular granular clumps which have long been known as Schultze's granule masses.

*Name.*—It will be necessary, at the outset, to refer to the names which observers have given to this corpuscle. Unfortunately they are rather numerous, and no one of them entirely satisfactory. Donne (1), whose description is the earliest, called them *globulins*. Zimmerman (2) spoke of them as *elementary corpuscles*. Later, the collected groups were referred to as "*granular debris*" or Schultze's (3) *granule masses*. Among the more recent observers, Hayem (4) gave the name of *haematoblasts*, and Bizzozero (5) that of *blutplattchen*—*blood-plate*. Various writers refer to this element as the *third corpuscle*, while in the research of Kemp (6), just issued from the Biological Laboratory of Johns Hopkins University, the term *plaque* is used and has received the sanction of Prof. Martin. To the terms *third corpuscle* and *haematoblast* there is the serious objection that these names have been applied to other bodies which have nothing to do with the elements in question. The former, to the so-called invisible corpuscle<sup>1</sup> of Norris, and the latter to the nucleated red corpuscle of the bone marrow. The name *haematoblast*, moreover, carries with it certain theoretical conceptions regarding the functions of these bodies which may or may not be true. I am inclined to favor the name which Bizzozero has adopted, partly (p. 366) because we are indebted to the distinguished Turin Professor for a series of able researches which have awakened the liveliest interest in

<sup>1</sup> Shortly after the publication of Bizzozero's paper, Norris claimed that the corpuscles described in it were the same as the barely visible corpuscles of his "fugitive group," but a study of the beautiful photographs in his book, will, I think, convince anyone with a practical knowledge of the blood-plates of Bizzozero, that they are separate elements. The granules which he figures (Fig. 45) as resulting from the breaking up of the younger or fugitive corpuscles are in reality the disintegrated blood-plates. Moreover, the corpuscles which he figures are uniformly larger than the blood-plates.

these corpuscles, and partly because usage of late has confirmed the name. Blood-plate, the English equivalent of the word *blutplattchen*, is by no means euphonious, while the French *plaque*, adopted by Kemp, is perhaps more convenient and might be employed in the future by American and English writers.<sup>2</sup>

*Methods of Study.*—Let us first consider the plaques in blood examined in the usual manner, without the addition of any reagent; and let us suppose the blood to be taken from a case of consumption or cancer, or from a newborn animal, as in these states these corpuscles are abundant. We find then, in addition to the red and colorless corpuscles, many grayish-white granular masses of various sizes and shapes. Examined at once, and if too much pressure is not exercised by the top-cover, the edges of these masses are clearly defined and they form compact aggregations. With a power of 500 diameters, the composite structure is well seen and the granular character is plainly discernible to be due to the agglutination of numerous small bodies of uniform size. At the edges, isolated or partially free corpuscles can usually be noticed. The fibrin filaments, as coagulation proceeds, seem to radiate from the masses as centres. This remarkable conglutination of the plaques and a tendency to undergo rapid change have retarded greatly the recognition of the corpuscles as veritable elements of the blood. Observers have, as a rule, seen in them nothing more than a granular debris of no special significance. Nor is this to be wondered at, as they so quickly undergo change that the clusters, in the course of a short time, really present the appearance of disintegrating protoplasm (Fig. 1, b). The size and shape of the groups are most variable; the more abundant, as a rule, the plaques the larger and more numerous the aggregations; the smaller ones, composed of two or three plaques, may not equal in size a red corpuscle, while the larger ones may be ten or fifteen times this size. A tendency to adhere to foreign particles is very noticeable, and they will collect in numbers upon a

<sup>2</sup> I did think of suggesting the word *disklet* as very suitable for these *little disks*, but I had not the courage to add another to the already long list; moreover, as my own name has been used in connection with these bodies, I felt absolved from further sponsorial duties on their behalf.

fine thread of cotton or linen. In the normal blood of the adult the plaques are not very numerous, and so do not form very large collections. In some individuals, however, in health the groups are always of considerable size. There are conditions of the blood in which, from some cause, the attraction of the plaques to each other appears diminished, and instead of forming large masses, they adhere to the slide either isolated or in scattered groups of from two to ten in number (Fig. 1, c). Possibly this may be an accident of preparation, but I am inclined to think it not, from the fact that I have noted it in cases of malignant fever, smallpox, scarlet fever,—the very states in which the normal process of nummulation of the red corpuscles may be so altered that the cells aggregate into compact clumps. In fact, the red corpuscles and the plaques in normal blood have each their peculiar mode of aggregation. The red in series and the plaque in masses. I have never seen any appearance which would suggest that the plaques have the slightest tendency to adhere by their flat surface, and to form rouleaux, as the red. It will be found too, I think, that just as there are, apart from modes of preparation, peculiarities which interfere with the normal nummulation of the red, so there are conditions in which the plaques present variations in their usual method of aggregation.

It was a consideration of the relative size of the masses, and the impossibility of their passing through the capillaries, which led me in 1873, in University College Laboratory, London, to the discovery of their corpuscular nature; and it was found that while in the blood of the young rat, when withdrawn, the masses were numerous and large, in the bloodvessels the collections, as such, never occurred, but innumerable small corpuscles, similar in character to those seen at times so plainly at the edge of the masses.

To study the plaques properly, the blood must be allowed to pass directly into a solution which, while preventing conglutination, does not materially alter their form or characters. Or they may be, perhaps, more satisfactorily observed while still within the bloodvessels.

Various solutions have been employed by different observers.

Zimmerman, whose study of these corpuscles was really very complete, allowed the blood to flow directly into a solution of a neutral salt which prevented coagulation, and then in the supernatant fluid he found small colorless cells in extraordinary numbers. I have repeatedly confirmed this observation in the case of horses' blood, when demonstrating the common experiment of preventing clotting, by letting the blood flow into sodium sulphate. The plaques abound in the clear serum, and if the solution is not too concentrated they are very little altered. In using the haematocytometer (Gowers), the sulphate of soda with which the blood is mixed acts in the same way, although in the counter it is more common to find the plaques aggregated than isolated, but the individual plaques are unusually distinct. More suitable solutions for histological purposes are osmic acid 1 per cent., the fluids of Pacini, modified by Hayem, and of Bizzozero. Pacini's solution, as used by Hayem, consists of sodium chloride 1 part, sodium sulphate 5 parts, corrosive sublimate 0.5 part, in 200 of distilled water. Bizzozero employs the ordinary salt solution,  $\frac{3}{4}$  per cent, to which methyl-violet has been added. Afanassiew (10) (p. 367) recommends strongly the use of salt solution to which 0.5 per cent of dried pepsin has been added, and 1 to 1000 of methyl-violet, and a small amount of sublimate or carbolic acid to prevent decomposition. I find that the Pacini fluid and osmic acid answer every purpose, and in them the plaques undergo very little change. The examination is made in the following way: Upon the thoroughly cleansed finger-pad a single drop of the solution is placed, and with a sharp needle, or pricker, the skin is pierced through the drop, so that the blood passes at once into the fluid, which is then received upon a slide and covered. The withdrawal of the corpuscles into the solution prevents the plaques from aggregating, and they remain as isolated and distinct elements. The amount of blood allowed to flow into the drop must not be large, and should be quickly mixed. In many respects the most suitable medium is osmic acid,  $\frac{1}{2}$ –1 per cent, which has the advantage that by its use permanent preparations can be obtained. The various cells are at once fixed, and the plaques are, by this method,

very well preserved. Good preparations may also be obtained by spreading rapidly a thin film of blood on a top cover, and then placing it at once in the osmic acid. Still another method is to dry the blood in the thinnest possible layer, and then fix with osmic acid or stain with methyl-violet, and mount in balsam. Kemp recommends placing the blood drop on a top cover, rapidly moving it about, and then washing off the superfluous blood with salt solution. The plaques adhere to the cover, while the red cells are swept away. The cover is then quickly put in osmic acid.

For the study of the plaques in the circulating blood, the mesentery or omentum plate must be employed, and a similar measure adopted to those used in the study of the circulation of the blood in mammals. The half-grown rabbit, white rat, or guinea-pig will be found best adapted for this purpose. The chief difficulties arise from the amount of fat which, in some instances, obscures the vessels, and the rapidity of the current may render it hard to see the plaque. But when, as in the omentum, a small transparent vessel is found, in which the current is slow, then with the red and colorless corpuscles the smaller plaques are also seen (Fig. 2). In Bizzozero's paper, and in the recent communication of Eberth, full directions are given for the study of the plaques in the circulating blood. They are modifications of the original Sanderson-Stricker method (*vide* Sanderson's *Handbook*), which answers every purpose in the case of the guinea-pig, the omentum of which is a peculiarly suitable object. In the rapidly flowing current no plaques are distinguishable, but when the stream is slow they can be seen here and there in the still layer with the white corpuscles, while if the current becomes very feeble they tend to collect at the periphery with the leucocytes. In a small venule, where the stream is slow, and only a few corpuscles passing, the best opportunity is afforded of seeing the plaques. They may be well studied within the vessels in the recently killed animal, or in man, in portions of tumors, etc., recently removed. The subcutaneous tissues of the newborn rat afford perhaps the very best situation in which to study the plaques while within the vessels. The rat is killed with a

ship of the scissors through the spine, and then portions of the mucoid connective tissue spread thin upon the slip, either with or without saline solution. In the thin transparent vessels, the plaques are very distinct, and they remain unchanged for hours. Perhaps there is no better mode of studying these forms, as the thin walls offer no impediment to the view, and the plaques are in their natural medium. In the subcutaneous tissue of man I have had several opportunities of examining the plaques in this way, and Fig. 3 represents them in a vessel of the tissue of the scrotum an hour after its removal. In the smaller vessels of the pia mater they may also be seen.

*General Characters and Structure.*—The plaques are minute elements circulating in the plasma with the other corpuscles, and possessing such specific and distinct characters that they must be reckoned among the normal histological constituents of the blood.

The plaque is colorless, with a uniform grayish-white appearance, homogeneous or very finely granular, and presents no differentiation in the delicate protoplasm of which it is composed. So far as my observation goes, it is always colorless.

The *size* is variable. In man they may be said to measure from 1.5 to 3.5 micromillimetres, or from about one-sixth to one-half the size of a red blood-corpuscle. The majority of them are from 1.5 to 2.5 $\mu$ . (p. 368) Occasionally a plaque may be seen measuring as much as 5 micromillimetres, but this is exceptional. When they are abundant, remarkable gradations in size may be measured between the smallest and largest forms. They have not the constancy in size of the red corpuscle. I think in man, when very abundant, the average size is slightly less than when they are not so numerous. They are stated to bear in size some relation to the size of the red corpuscle of the animal, but we need a more elaborate series of measurements to determine this. In the white rat they are slightly smaller than in man.

The shape of the normal plaque, as seen in the vessels, is a circular disk with smooth, well-defined margin. When slightly tilted it has naturally an ovoid appearance, and when seen in profile is as a narrow, straight rod or staff. Whether they are



flat disks, or biconcave, as like red corpuscles, is really not easy to determine. I should say that the majority do not show a bilateral depression, but forms are sometimes seen which resemble in outline very closely a miniature biconcave disk. Alterations in form quickly occur when the blood is withdrawn; but the natural shape, as seen in the vessel, and also, as a rule, in Pacini's fluid, or osmic acid, is as here stated.

The plaque consists of a homogeneous, smooth, structureless protoplasm of a light gray color. In the unaltered condition no nucleus can be seen, but in the fluids used to conserve them the appearance is in the form of a collection of distinct granules, which may look like a nucleus. This will sometimes, in dried preparations, stain a deeper color in the haematoxylon than the remainder of the plaque, and it is regarded by Hayem as a nucleus.

*Changes in the Plaques.*—Outside the vessels the plaques are characterized by two peculiarities which have been a serious hindrance to their recognition as special elements of the blood, viz., the rapidity with which the protoplasm alters the tendency to adhere to one another and to any substance with which they may come in contact. Within the vessels, however, they do not seem to be more prone to rapid decay than the red or white corpuscles, and in the young rat, kept at ordinary temperature, I have seen them in the vessels quite distinct and clear twenty-four hours after death. So also I have found them unaltered in the vessels of the pia mater in man, some hours after death; and, as I shall have occasion to show in the third lecture, they may in masses remain apparently unchanged for some time.

The substance composing the plaque appears homogeneous when first seen, but soon a change occurs, and the plaque presents a darker, more highly refractile portion and a clearer substance. Usually this darker portion is peripheral, but it may be central, and then is not unlike nucleus. It is as if a material had separated from the stroma or bases of the plaque, just as the haemoglobin of the red corpuscle may do under the influence of reagents. The plaques undergo the most curious changes in shape, to the study of which I devoted much time in 1873. Within the vessels

they are circular, but when at rest they not unfrequently become ovoid or prolonged, or slightly angular and crenated. These angular processes may increase greatly in length, and give a stellate appearance to the plaque. The changes in form are very fully described and figured in my original paper. These alterations are probably induced by changes in the external conditions, and are not amoeboid or vital in character. The addition of serum to the blood drop, and the examination in a warm stage, affords the best means of studying the variations in form. Even within the vessels they may show these changes, and in the course of a few hours alter in a remarkable manner so as to be scarcely recognizable.

A very common change is the separation from the plaque of a mucin-like (?) material in the form of a pale sphere, which may remain attached to the cell or separate from it. When aggregated in masses, as in a slide of fresh blood, this process can be readily seen at the margin, and the field in the vicinity may be covered with these pale globular bodies. They result, doubtless, from the separation of some material from the substance of the plaque, and are identical with the spheres so often seen attached to spermatozoa in urine.

In marked contrast to the stability of the plaques within the vessels is their rapid disintegration when withdrawn. At a low temperature this does not occur so quickly, and of this Hayem took advantage in his researches; but at the ordinary temperature, and of the examination of the blood without any reagent, the plaques unite with each other and undergo rapid change—a viscous metamorphosis, as Eberth (11) terms it. As I shall have occasion to point out, this is associated with the separation of fibrin which seems to arise first about the groups of plaques, as Ranvier noted in 1873, and he spoke of these little granulations—*grains sarcodique* of Vulpian—as centres of coagulation.

*Action of Reagents.*—This has already been referred to in the consideration of the best modes of examining and preserving the plaques. Water reacts upon them as upon the colorless elements, causing a swelling of the protoplasm and a rapid production of the pale spheres already described. Dilute acid and saline solu-

tions act in the same way. In three-fourths per cent salt solution, or in the sodium sulphate solution for blood counting, they retain their outlines and do not so rapidly coalesce and disintegrate. Dilute potash solution causes speedy dissolution.

The aniline dyes stain the plaques as other protoplasmic bodies, and Bizzozero's fluid has the advantage of (p. 369) tinting them and making them more distinct. In preparations by Ehrlich's method, the tint of the central portion of the plaques may be deeper than the periphery. Carmine appears to have no effect. For permanent preparations the dry method is the best, and they may be stained with haematoxylin, fuchsin, Bismarck-brown, or methyl-violet. The blood in osmic acid may be kept for some days if the cover-glass is carefully surrounded with paraffine. A solution of corrosive sublimate 1:1000 is also suitable for their preservation. The precise chemical composition of the plaques has not been determined, but from the similarity in most points of their reaction and behavior with dyes to the nuclei of cells, we may suppose their composition to be of a similar nature.

*The Number.*—The numeration of the plaques presents serious difficulties, on account of their extraordinary adhesiveness and the numbers now given, may be subject to revision when better methods are devised. In my own case the numbers range from 250,000 to 300,000 in the cubic millimetre, figures which correspond to those of Hayem. Full-blooded, plethoric individuals have rarely more than 250,000 per cubic millimetre. The variations in the same individual may be considerable during the day, and they seem increased after a full meal. Age has an important influence—in the infant and young child the number may be double that of the adult. In the newborn of all the mammals I have examined they were specially abundant. In advanced age they seem more numerous, particularly if the individual is weak and debilitated.

Until more extensive and more reliable counts are announced, we may say that the plaques in health number between 200,000 and 300,000, the ratio to the red being about 1 to 18 or 20, and to the white corpuscles 35 or 40 to 1. The numeration of the plaques is a much more tedious matter and requires far more

patience than counting the red and white corpuscles. Rapidity is essential to success. I find the *compte globule* of Malassez rather more adapted than the Gower's apparatus, as the mixture can be more thoroughly and quickly made. The blood is got from a deep puncture and aspirated into the tube of the Potain mixer and then the Pacini's fluid or osmic acid is immediately drawn in. Frequently it will be found that, with the greatest care, the plaques have run together and the process must be repeated. It is essential, too, in the first aspiration of the blood, to reach the line at once; if the blood column goes beyond, it must be discarded and a fresh attempt made, as the time lost in accurately adjusting the column would be sufficient to allow the plaques to coalesce.

*The Plaques in Disease.*—In health the plaques are relatively scanty, and they aggregate into such small, scattered groups, that they do not necessarily excite the attention of the student, but every constant observer of the blood in states of disease must have marvelled again and again at the extraordinary number and size of the granule masses met with in certain cases. Led away by their constancy and peculiar character, writers have regarded them as specific and distinctive elements in certain affections (leukaemia, phthisis). From the able and comprehensive paper of Riess to the more recent one of Afanassiew, there have been very many observations on the frequency and significance of these bodies in disease, but we still lack careful and painstaking enumerations in the various acute and chronic diseases. A rough estimate of their increase or diminution may be made by any one well accustomed to their observation, but for scientific accuracy the haematocytometer must be used, and means must be devised to overcome the present serious source of error.

My own observations have been very numerous, and I have for years been in the habit of noting the paucity or abundance of these elements. In the absence, however, of systematic and reliable counts the notes are not worth much. The general results I may state as follows:

1. The plaques are increased in all chronic wasting maladies—cachexiae—with or without fever.

This is very evident by examining in rotation the various

patients in a hospital ward. The debilitated individuals, the subjects of phthisis, cancer, or other chronic wasting diseases, present a marked increase. In phthisis the number per cubic millimetre may reach 500,000 or more, and the ratio of the plaques to the red may rise as high as 1 to 5.

2. In acute sthenic fevers the plaques are not increased in the early stages, but as the disease advances, and the patient becomes weaker and more debilitated, the increase is usually marked. This is well seen in typhoid fever, in which the number of plaques during the first week may not rise above normal, while in the third and fourth week there is usually a notable increase.

3. In the so-called blood diseases the number of the plaques is variable. Many observers have remarked the great numbers in certain cases of leukaemia, but in others the increase is not apparent. So, also, in lymphatic anaemia. In some cases of Hodgkin's disease I have seen the plaques in extraordinary numbers. In profound anaemia the plaques may be very scanty. I have long noted, in cases of pernicious anaemia, that the clusters of plaques may be almost absent, or much more scanty than in health.

*Distribution of the Plaques in Animals.*—So far as our present knowledge goes, the plaques are constant constituents of the blood in mammals, and, with the exception of slight variations in size, the general features are the same in the various orders. My observations on this point have not been extensive, but I can speak of their presence in the blood of the dog, cat, mouse, guinea-pig, rabbit, sheep, ox, horse, pig.

They also occur in the ovipara, and here they are nucleated. Kemp states that in the blood of oviparous animals there is a nucleated corpuscle which is physiologically analogous with the plaque in the blood of mammals, and which behaves like it when the blood is drawn.

*Origin.*—Various explanations have been given to account for the origin of the plaques, and Kemp enumerates no less than seven different views. Perhaps the most prevalent idea, particularly among clinical physicians, is that they result from the disintegration and degeneration of the blood corpuscles, espe-

cially the leucocytes. This is really not unnatural, for the irregular clumps of plaques in blood examined in the ordinary way look very like—and, indeed, are—protoplasmic *débris*. But we know of no such process of rapid disintegration in the colorless corpuscles, which are remarkably stable elements, and even in their death and (p. 370) decomposition never, so far as I can make out, produce structures similar to the groups of plaques. The fact that the formation of the *granular débris*, as the groups of plaques are called, can be prevented by drawing the blood directly into a drop of osmic acid (or Pacini's fluid), in which the elements are fixed instantly, should be sufficient to convince the most sceptical; but if it does not, the study of the plaques in the newborn rat will satisfy, I think, the most obdurate. The abundance and large size of the groups of plaques in a blood drop examined in the ordinary way, and the ready demonstration of the individual elements in the blood-vessels of the subcutaneous tissue, and the identity of these with the corpuscles at the edges of the groups, and with those in the osmic acid drop, render the conclusion irresistible that we are dealing with something quite independent of the colorless corpuscle.

I am unaware of a single observation corroborative of the view that the plaques result in any way from the degeneration of the red corpuscles. We need not consider the views that the plaques represent fibrin particles, or are depositions of globulin.

A majority of observers regard the plaques as independent elements in the blood, others agree with Hayem that they are young red corpuscles—haematoblasts—and a further discussion of this point will be best considered in the next lecture, when I speak of the regeneration of the corpuscles.

*Historical.*—I do not propose to enter into the literature of the blood plaque. This has already been done very fully by several German observers, and quite recently by Kemp, whose paper in the "Studies from the Biological Laboratory of Johns Hopkins University," will be readily accessible to all American and English students. In my original paper I have also given pretty fully the older references. We may conveniently divide the work which has been done in this department into three periods.

The first embraces the time prior to the publication of Hayem's researches in 1877. The masses had been observed frequently, and the corpuscles had been studied, notably by Donne, Zimmerman, and Max Schultze. In 1874 I demonstrated the corpuscular nature of the granule masses, and showed that the bodies of which they were composed "were present as separate elements in the vessels, and showed no tendency to adhere together." In 1873 Ranvier<sup>9</sup> called attention to their possible association with fibrin formation. Riess and others had called attention to their increase in disease. The second period dates from the publication by Hayem, in 1877-78, of his researches, and to him really belongs the credit of establishing the histological position of these corpuscles as constant blood elements. It is curious that his careful observations met with very slight recognition among physiologists. The interest in the question had almost died out when, in 1882, Bizzozero, of Turin, published an exhaustive article in Virchow's *Archiv* upon the *Blutplattchen*, and their relation to fibrin formation. From this we date the third period, during which there have been already published eighteen or twenty essays, chiefly in Germany, and the most intense interest seems to have been aroused in the subject. The weight of histological evidence is strongly in favor of the views which I have here laid before you, but there still remains the greatest diversity of opinion as to the function of these bodies in blood development, and of their relation to the formation of fibrin, and upon these questions I shall have more to say in the second and third lectures.

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## (p. 393) LECTURE II

### DEGENERATION AND REGENERATION OF THE BLOOD CORPUSCLES

The conception of the blood as a fluid tissue, the corpuscles representing the cells and the plasma the matrix, is not a very happy one, as both cell elements and matrix present peculiarities unknown in any other tissue. Rather it is to be regarded as an internal medium, to use Bernard's phrase, bearing the same relation to the constituent tissues as the external medium does to the individual.

In spite of local variations, the composition and characters of the blood present a remarkable uniformity, the result of the combined action of the receptive, excretory, and formative tissues, which are concerned in the digestion and absorption of food, in the discharge of waste, and in the renewal of worn-out elements.

The maintenance of the histological uniformity of the blood is absolutely dependent upon the integrity of these processes. In health the waste and repair of the corpuscles are not accompanied by any striking or obvious phenomena. The corpuscles present a remarkable sameness, and we cannot pick out with readiness the old elements ready to die, or the new ones which have just made their appearance. This it is which makes the blood such a puzzle, for the corpuscles, so far as observation goes, neither die nor are born in the circulating fluid, but appear to enter it as perfect elements and are removed from it before they are so changed as to be no longer recognizable.

That the red corpuscles in health are constantly degenerating and as constantly being reproduced, is universally acknowledged, though the facts upon which this belief is based are not very numerous. There is evidence that the coloring matters of the bile and of urine are derived from the haemoglobin, and to supply their daily amount many corpuscles must be destroyed,



and to replace which new ones must be formed. The variations in number at different times and under different conditions, indicate that waste and repair are ceaseless processes. Moreover, there is the direct evidence in the presence of degenerating red corpuscles in certain organs, spleen and bone marrow. Our very imperfect knowledge of the details of degeneration and regeneration of the corpuscles in health has been supplemented to some extent by experiment and by the study of the blood in disease, and I propose in this lecture to touch upon the salient features of these processes so far as we at present understand them. As it is difficult to separate the two conditions, which in many instances coexist, I shall first take up the consideration of the state of the corpuscles in anaemia, as induced either by increased destruction or loss of the corpuscles, or as it results from scanty production. The loss may be sudden, as from hemorrhage or acute poisons, or be a slow gradual process, as in fever and chronic poisoning. Anaemia from imperfect production of cells may result from primary changes in the cytogenic tissues, or be a secondary effect of imperfect nutrition, but in either case the reduction in the number of the red corpuscles is by far the most important change, and upon this the symptoms mainly depend.

In health the red corpuscles present a remarkable uniformity in size, or perhaps it is more correct to say that the variations which occur are within very narrow limits. The large proportion of the corpuscles have a diameter of  $7.5\ \mu$ , but there are a few to be found which measure a micromillimetre less or more,  $6.5$  or  $8.5\ \mu$ . These slightly smaller and slightly larger forms are not numerous in normal blood, not so numerous, I think, as Hayem's researches<sup>1</sup> would indicate, for he places the medium-sized at 75 per cent., the smaller forms at 12 per cent., and the larger at 12 per cent. Gram,<sup>2</sup> who has made a number of careful observations on this point, finds the average diameter to be a little more than  $7.5\ \mu$  ( $7.8\ \mu$ ), but the percentage of corpuscles of less or greater diameter varies greatly in different individuals.

<sup>1</sup> Leçons sur les modifications du Sang, 1882.

<sup>2</sup> Fortschritte der Medecin, 1884.

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In the newborn, and for some time after birth, the maximum and minimum diameter of the red corpuscle presents a much wider range, the variations being from  $10.3\mu$  to  $3.3\mu$ . One of the most striking alterations of the red corpuscles in certain diseased states is a reversion to this embryonic or infantile condition, with a variation in the size of individual corpuscles to a degree which is truly remarkable. Instead of an extreme variation of  $2\mu$  as in health, the range between the smallest and largest forms may be from  $8\mu$  to  $10\mu$ , or even more. Thus, minute corpuscles may be measured from  $2.5\mu$  to  $3.5\mu$  while contiguous cells may be as much as 10, 12 or even  $14\mu$ . To these abnormal forms the terms microcytes and megalocytes have been appropriately given.

*Microcytes* occur normally in the blood of the embryo (Fig. 10, b) and newborn, but are rarely to be seen in a healthy adult. In disease they are most abundant in anaemia, whether from hemorrhage or as a result of changes in the cytogenic organs, or secondary to disease of important viscera. When the attention of observers was first directed to these bodies it was thought that they might be of diagnostic import in (p. 394) certain forms of anaemia, but we know now that they occur—in variable numbers, it is true—in all forms, in chlorosis, splenic anaemia, pernicious anaemia, leukaemia, Hodgkin's disease, and in the anaemia of cancer, phthisis, and other chronic affections. I must say, however, that so far as my personal experience goes I have not met with them so uniformly or so abundantly in any condition as in those cases which we designate by Biermer's name of progressive pernicious anaemia. In what may be called the primary anaemias they are almost invariably to be found, while in the secondary form they are variable and may be absent. There is unfortunately a difference of opinion as to the nature and origin of the microcytes, some regarding them as disintegrated remnants of corpuscles, others as young forms in process of development. Possibly both views may be correct. The small, spherical bodies of a deep red color,  $1.5$ – $2.5\mu$  in diameter, should, perhaps, be distinguished from the forms slightly larger, more distinctly discoid, and less deeply tinted. That they may result from changes in the ordinary red corpuscles is, I think,

certain. I have frequently noticed that they appeared to increase in a slide kept for observation. They resemble, too, particularly the small deep red ones, the fragments into which the red cells disintegrate under the influence of the induction steam and of various solutions. In a freshly prepared slide of anaemic blood firm pressure on the top cover will sometimes be sufficient to produce a large number of microcytes which result from the destruction of the red corpuscles by pressure. They may, indeed, be observed in process of formation as shown at Figs. 2 and 3. Normal blood in Pacini's fluid does not often show special changes in the form of the corpuscles, but the corpuscles, in cases of profound anaemia, may become in it very irregular in outline and deeply fissured as sketched at Fig. 2, and portions may separate and appear in the field as microcytes. In the bone marrow, too, I have often noted a somewhat similar process (Fig. 3), and by a sort of budding and fission many small forms may arise. These microcytes are not always to be regarded as a result of post-mortem change, they may be seen in blood examined with the greatest possible rapidity after removal. Whether the slightly larger form of microcytes from  $2.5$  to  $5\mu$ , and which are often less deeply tinted, arise in the same way is still an unsettled question. They occur with the others, but are regarded, as I shall point out later, by many good observers as developing forms.

The *megalocytes* have attracted less attention than the smaller forms, but are equally curious. The term may be applied to forms above  $8.5\mu$  or  $9\mu$  in diameter. They may reach an extraordinary size,  $12$ ,  $14$ , and even  $15\mu$ . They are very constant elements in cases of pernicious anaemia, and also occur in chlorosis and leukaemia. Gram<sup>1</sup> has made the interesting observation, which I have been able to confirm, that these forms occur in numbers in cases of icterus. He also states that ordinary red corpuscles placed in icteric serum (of ascites in cirrhosis) seem to increase somewhat in size. We may call to mind in this connection the peculiar lemon or subicteroid tint of the skin in

<sup>1</sup> Fortschritte der Medicin, Bd. ii.

many cases of pernicious anaemia, and possibly there may exist in the blood-serum some element—the product of destruction in the haemoglobin—which may act upon the red cells and cause them to assume a more flattened form. These megalocytes often show the most eccentric changes in outline, to which I shall shortly refer. When I speak of the development of the corpuscles, I shall return again to these forms.

In the normal red corpuscles regularity in outline is not less constant than uniformity in size, but in the blood of the various anaemias we now recognize the loss of this character as a very distinctive feature. Here, also, many of us erred in supposing this condition to be peculiar to pernicious anaemia, the disease in which these irregular forms were first accurately described. Quincke called them *poikilocytes*, a term which has been very generally adopted. At Figs. 1 and 2 this condition is represented. The corpuscles may present the most remarkable shapes, ovoid, elongated, pyramidal, balloon-shapes, with indented edges, or rods, either straight or bent at right angles. Many of these bizarre forms are scarcely recognizable at first as red corpuscles. I still hold that we meet with these forms in a more extreme degree in cases of pernicious anaemia than in any other disease, but they occur also in the anaemia of phthisis, cancer, and inanition. This is a physical change depending probably upon alterations (p. 395) in the blood serum. It is not induced in the healthy corpuscles by the dilution of the serum or slight grades of concentration or by any of the reagents which tend to produce crenation. In Pacini's fluid the corpuscles of anaemic blood may sometimes be observed to become much more irregular in form (Fig. 2).

*Percentage of Haemoglobin.*—We know as yet little or nothing of the processes associated with the production of the coloring matter of the corpuscles. In a state of health the percentage of haemoglobin in each cell is tolerably definite, varying within very slight limits. In diseased conditions we have learned to recognize two remarkable changes in the relation of the coloring matter of the corpuscles. One is the observation made some years ago by Duncan (1867) that the haemoglobin in chlorosis

was reduced out of proportion to the reduction of the corpuscles, so that the individual worth of each red corpuscle in coloring matter might be very greatly lowered. The true anaemia might be much greater than the number of red corpuscles per cubic millimetre might indicate. Subsequent researches have fully borne out this fact, for which, however, we have as yet no suitable explanation. The pallor of the corpuscles may even be recognized with the microscope. In ordinary anaemia from hemorrhage or organic disease, the average worth in haemoglobin of each corpuscle usually remains unaltered and the percentage of coloring matter corresponds closely with the percentage of the corpuscles, but in certain cases of pernicious anaemia the interesting fact has been ascertained that the percentage of haemoglobin in each corpuscle is increased, and the anaemia in reality may not be so great as the reduction in the number of red corpuscles would appear to indicate. The individual worth of each corpuscle in haemoglobin may be actually doubled and the heightened color be evident on microscopic examination. These two facts, intensely interesting and suggestive, may be said to comprise our knowledge of the changes in haemoglobin percentage in the corpuscles in disease, and they serve as a background against which to display our ignorance of this most essential feature in haematogenesis.

*Nucleated Red Corpuscles.*—In anaemic states there may be present in blood, nucleated red corpuscles such as normally occur in the blood of the embryo, and such as are present in the red marrow of the bones. I have not met with these elements so frequently as the statements of certain observers (Ehrlich) would lead us to suppose. Certainly they do not occur in all cases of profound anaemia. I have met with them in leukaemia in larger numbers than in any other state. (Fig. 4.) They present characters identical with the nucleated red cells, which I shall speak of shortly in connection with the regeneration of the corpuscles. They are usually a little larger than the ordinary red corpuscles, and the tint may be slightly paler. The nucleus may be seen in process of division, and I have seen corpuscles in process of fission, identical in appearance with those long ago

described and figured by Kolliker, as occurring in the blood of the embryo. They may not be infrequently found in groups of three or four, close together, or even in contact, as if the group had resulted from the division of a single corpuscle. I was particularly struck with this feature in one case of leukaemia in which they were very abundant, and I regard the explanation just given as a very likely one in the light of the recent observations of Bizzozero, upon the rapidity of the process of division in these forms. That they originate in the bone marrow there can be no doubt, and in my experience it is just in those conditions in which this tissue is hyperplastic, that they occur in the blood.

A rare and odd element in the blood is the *corpuscle containing red blood-corpuscles*. Several observers have noticed the presence of red cells inside colorless corpuscles in the circulating blood. It is very uncommon, and the sketches at Fig. 5 represent the only examples which I have met with. Considering the abundance of these cells in the marrow, spleen, and lymph glands in certain states, it is surprising that we do not find them more often in the blood. It is quite possible, however, that the colorless corpuscle circulating in the blood may itself take up a red cell into its interior just as it may an oil drop or a particle of pigment. I have a sketch of a colorless corpuscle of the blood of the frog, with three or four human red corpuscles in its interior, which it had *eaten*. I have sought in vain in chronic malaria, for evidence that the leucocytes in the blood take the corpuscles entire into their interior in the formation of the black pigment. They would appear to take in the disintegrated particles, possibly in the spleen and liver, but not the entire cells.

It is interesting to compare with the sketch I have thus given of the state of the corpuscles in anaemia with the condition of the blood in the acute anaemia following a profuse hemorrhage, either accidental or experimentally induced. With our present knowledge, there is a really serious difficulty in deciding just what features of the blood indicate degeneration and what a process of regeneration. Thus, the microcytes, as I have stated, are regarded by some as evidence of a retrograde process, by others as indicating repair of the waste. In an animal deprived of one-

third of the amount of blood, or in an individual after a severe prostrating hemorrhage, the changes noted are almost identical with those already described. 1st. The red corpuscles display irregularity in size and shape. The microcytes are numerous and resemble in all respects those of chronic anaemia. The larger forms of red corpuscles are not so constant. Poikilocytes also occur. As the percentage of red cells approaches the normal, (p. 396) these irregularities diminish in a marked manner. 2d. The colorless corpuscles are relatively, and may be even absolutely increased in number. This doubtless is the result, in part, of a relatively smaller loss in white corpuscles in consequence of their adhesive, wall-loving property, and in part, to the flooding of the blood current with leucocytes poured in with the copious flow of lymph which takes place to make up the volume of blood. 3d. The nucleated red corpuscles may appear. In the experimentally induced anaemia in animals (dogs) they are more abundant than after profuse hemorrhage in man (cirrhosis, haemoptysis). 4th. There is a marked increase in the number of the blood plaques.

*Regeneration of the Corpuscles.*—There is probably no subject in physiology upon which opinions differ more widely than in the mode of formation of the corpuscles—particularly the red—after birth. The possibility of a solution of the question seems to have been offered in the discovery of the blood-forming function of the red marrow by Neumann and Bizzozero, and the positive assertions of Hayem regarding the blood plaque and its connection with regeneration, have served to arouse again the interest in this important question.

I propose to lay before you briefly a statement of the current views, as interpreted in the light of more recent investigations, and I shall first direct your attention to the study of the formation of red corpuscles in the *bone marrow*.

I begin with this, as I here feel more at home, having for some years been an observer of this tissue in various states, and having arrived at certain conclusions which appear to be justifiable. The red marrow which in the newborn and young child occupies the bone cavities of the entire body, is confined in the adult to

the cancellae of the short and flat bones, but even with this limitation the entire bulk is very great, and if massed as one organ would exceed considerably the volume of the spleen. Without entering into preliminary histological details on the structure of the marrow, which are now incorporated in the text-books, I shall proceed at once to the consideration of the cell elements of this tissue. With a fine capillary pipette a small quantity of the soft red marrow is placed upon a slide without any reagent and a thin cover applied with gentle pressure so as to procure a layer of uniform thinness. The plasma of the marrow is usually quite sufficient, and there is serious objection to the addition of any reagent, as the delicate colored stroma of many of the cells may be at once altered. I feel sure that neglect of this precaution, so strongly emphasized by Neumann, has time and again prevented observers from seeing the very objects they were in search of, and they have ended with a denial of their existence (Rutherford, *Histology*). Examined in this manner we can usually see the following elements: 1. Ordinary marrow cells, (a) with coarsely granular protoplasm (Fig. 7, a), coarser-looking than that of a colorless blood-corpuscle. The nuclei may not be apparent at first, but they gradually become distinct, two or three in number, oval, round, or reniform in shape and vesicular in character. On the warm stage these elements display feeble amoeboid movements.

b. Smaller cells about the size of colorless corpuscles with more solid nuclei and less granular body protoplasm; they are not so numerous as the larger cells and some of them may be colorless blood-corpuscles.

2. Marrow cells (9 to 12 $\mu$  in diameter) with smooth homogeneous protoplasm (Fig. 7, d) and finely granular nuclei, indistinct on first examination, but becoming more apparent in a few minutes. The protoplasm surrounding the nucleus is translucent, homogeneous, colorless, and variable in amount. There may be a single large nucleus surrounded by a narrow rim, or there may be a dumbbell-shaped nucleus, or it may be divided into two, or even three. The process of indirect (p. 397) division of the nucleus can be well traced in these forms. Certain of the



cells may present the faintest possible tint of color, and as they are carried about among the other corpuscles they show a peculiar flexibility.

3. Small lymphoid elements, resembling free nuclei; solid-looking, homogeneous,  $2.5-5\mu$  in diameter, Fig. 7, c. They resemble the smallest lymph corpuscles, but about many of them no distinct rim of protoplasm can be seen. In others there is a faint border of protoplasm. These bodies are variable in number but they may be regarded as constant elements of the red marrow. Identical structures may be found in the spleen, Fig. 11, 4. They are well described by Norris as the "primary lymph cell."

4. Nucleated red corpuscles, which we may regard as the special element of the red marrow, and which are present at all periods of life, Fig. 8, a. They range in size from  $6\mu$  to  $12\mu$ , and are circular or slightly ovoid in shape. When freshly examined the protoplasm is homogeneous, clear, and the nucleus indistinct. The color is of all grades up to the intensity of an ordinary red corpuscle. As they float about in the current they show the flexibility and elasticity of the ordinary colored forms. The nucleus may be single and large, and is frequently seen in all stages of division. It is not colored. In certain cells there are appearances which indicate that the nucleus undergoes changes prior to disappearing, becoming granular and indistinct. In some specimens the nucleus can be seen adherent to the edge of the cell as if in process of migration from it (Fig. 9), and bodies of a similar appearance may be seen in the immediate vicinity of the red cells.

5. Red corpuscles of ordinary form and appearance. Upon their abundance or paucity depend the color of the marrow. In addition to the usual biconcave disks there are commonly megalocytes, especially if the marrow is hyperplastic, and a variable number of microcytes. The larger corpuscles are, I think, more frequent than the smaller ones.

6. Myeloplaques or giant cells, the description of which need not detain us, and

7. Corpuscles containing red blood cells (Fig. 6, b, 1). Some

of these are evidently collections of red corpuscles undergoing disintegration to form the cells containing granular pigment (Fig. 6, b, 2), while others, resembling rather the giant cells (Fig. 6, b, 3), may possibly bear a different interpretation.

The chief interest centres in the nucleated red corpuscle of the marrow and of the spleen. From what does it originate? What is the process of its conversion into the ordinary red disk? All are agreed as to its importance in blood-making. It is the earliest red corpuscle in the embryo; it is constant in the cytogenic tissues of all animals, and it would be unreasonable in the highest degree to suppose that in the red marrow of the adult it was present for any other purpose. Moreover, in states of anaemia and after bleeding, the nucleated red corpuscles increase in the bone marrow and even appear (overflow) in the blood; and lastly, Bizzozero has watched the process of division, which may occur with remarkable rapidity, within fifteen minutes. My observations lead me to regard the nucleated red corpuscle as the product of transformation of the clear-bordered homogeneous marrow cell, as all grades of tint can be seen, between cells with scarcely a trace and strongly colored forms. There is no essential difference apparent in the body protoplasm, in both it is smooth, flexible, and translucent. It is not difficult to outline corpuscles in series from those without a trace of color to forms well and clearly tinted. The colorless marrow cells with clear-bordered protoplasm appear to be the descendants of the solid lymphoid cells—the primary lymph corpuscles—the protoleucocyte—which gradually becomes surrounded by a zone of homogeneous protoplasm. Certainly intermediate gradations can be seen between the forms figured at Fig. 7, c, and the smaller corpuscles at Fig. 7, d. The process of transformation of the nucleated red into the ordinary forms, occurs, I believe, by the gradual disappearance of the nucleus, as shown at Fig. 8, b, 1, 2, and 3. It seems impossible to draw any other conclusion from a study of such cells, and the small granular remnants which they contain may be the sole means of distinguishing them from ordinary red corpuscles. Very many observers have recorded the fact of the migration of the nucleus from the cell, and it may be seen

in all stages of the process as represented at Fig. 9, but I have not been able to convince myself that this is anything but a post-mortem change. Certainly in the fresh marrow there are not nearly so many corpuscles with nuclei partially extruded, as in a specimen kept for twenty-four hours. Rindfleisch regards this as the normal mode of transformation, and we need additional careful observation on the point. In favor of the view that the nucleus undergoes disintegration is the fact that a similar process may be traced in the nucleated red blood cells of the embryo, as shown at Fig. 10, a, and as the cells are identical in appearance and probably in origin, this may be regarded as strong confirmative evidence. Bizzozero, whose careful study of this question entitles his opinion to the greatest consideration, regards the nucleated red corpuscle as a fixed and constant element derived, by fission, from preexisting forms of the same kind, and not by any process of development from colorless cells of the marrow.

The nucleated red corpuscles are slightly larger than (p. 398) ordinary blood-corpuscles, and in size resemble the megacytes which are usually abundant in the bone-marrow. Such a cell as is represented at Fig. 8, b, 4, differs in appearance from those at b, 1, 2, 3, solely in the absence of nuclear remnants. In the further process of development into the ordinary red corpuscle, we must suppose condensation of the stroma and a change from a flattened cell to a biconcave disk. In anaemia the megacytes which may be so abundant in the blood are to be regarded as imperfectly formed corpuscles, which, from causes as yet unknown to us, have not attained their proper form.

Possibly in other ways the spleen and marrow elements may participate in blood formation. I have already referred to the process of budding which may be seen in certain of the red cells of the marrow (Fig. 3) and of the spleen, and Malassez looks upon these gemmae as capable of development into ordinary red forms.<sup>1</sup> The difficulty is one of interpretation; the process can be readily followed, but, as I mentioned, it is probably a physical change.

<sup>1</sup> Creighton has described the formation of colored corpuscles in blood cysts by budding from embryonic cells lining their walls, and a few years ago Johnstone maintained (*Sequin's Archives*, vol. vi.) that the red cells developed by budding from the granular protoplasm of the adenoid reticulum of the spleen and lymph glands.

Within the large myeloplques and also in the elongated cells of the stroma of the marrow, there can be seen, occasionally, red corpuscles, which suggest *development* not *disintegration*; inas-much as the corpuscles are in smaller number and show no traces of degeneration. They are figured at 6 a, 1, 2, 3, from the spleen, and at 6 b, 3, from the marrow. I have been struck with the close resemblance of such cells to those in the subcutaneous tissue of the young rat, in which the process of intracellular development of red corpuscles can be readily traced, as shown by Mr. Schafer. Fig. 6 c, represents one of these connective tissue corpuscles with four developing red cells in its protoplasm. It is quite possible that in the reversion to the embryonic or foetal state of the bone-marrow, these cells may resume their haemato-genous function, which seems to be a widely distributed property in the protoplasm of mesoblastic (parablastic?) elements.

The relation of the plaque to blood formation is still undetermined, and the most diverse views prevail among those who have studied the question. Hayem argues that they are true *haematoblasts*, and the red corpuscles arise directly from them, basing his opinion upon the following grounds: 1. The shape of the plaque is discoid, resembling a miniature blood cell; 2. The faint tint of color which he says may be observed in them; 3. The remarkable gradations in size which they present, so that a complete series of forms may be traced from the smallest plaque to a common blood disk; 4. Their paucity in the healthy adult, their abundance in the young, and in all conditions in which blood formation is rapidly going on; 5. Their occurrence in the cells of the blastoderm. These views of Hayem have met with active opposition from a large majority of the observers who have studied the blood plaque. I have never been able to detect coloration in the plaque, but in the larger forms the pale gray-white aspect of the protoplasm seems most distinct. I cannot see any connection between the blood plaque and the ordinary microcyte, which is of a deep red tint, even when as small as the smaller plaques. The larger microcytes,  $4-5\mu$ , which are usually paler in tint, have a homogeneous and distinctly colored stroma, precisely similar to the red corpuscle, and unlike plaques of the same

size. Fig. 11 gives a representation of a group of elements from the spleen with the blood plaques, five or six in number: 1, are of various sizes, and presented a pale, faintly granular protoplasm; at 2, were seen two microcytes, resembling more closely miniature blood disks than the form represented at Figs. 1 and 4, but though resembling in size the larger plaques, the appearance is totally different, and forms intermediate between them are not seen. A strong point in Hayem's theory is the abundance of the plaques under the very conditions in which the corpuscular production goes on rapidly: (1) in the embryo and newborn, (2) after hemorrhages, (3) in the stage of convalescence from acute diseases. So, also, in chronic wasting diseases, and in certain forms of anaemia, their prevalence may be reasonably explained by failure to develop into more mature forms. We enter here the region of hypothesis, and it must remain for future observers to determine the precise position of the plaque in the development of the corpuscles. There is remarkable unanimity of opinion among those who have lately worked at the subject, to the effect that the evidence is at present altogether insufficient. Afanassiew is an exception, but he holds that the plaque develops into the nucleated red blood-corpuscle, the nucleus of which is in turn extruded and becomes a plaque.

The observations of the past ten or twelve years have led us away from the old view that the red cells are derived from the colorless corpuscles. Except in the (p. 399) mode I have indicated in the marrow, there is no evidence in favor of the conversion of the colorless corpuscles into colored forms, and the opinion is gaining ground daily that they constitute separate elements with important functions quite apart from regeneration of the red cells. They constitute so many masses of primitive or basis-protoplasm which may be called upon in the repair and reproduction of tissues and in the healing of wounds. They act as scavengers—*phagocytes*—in the removal of dead parts, or enclose injurious particles in their interior, and so render them inert. The leucocytes of the body have been compared to a standing army ready to resist invasion, and inflammation, in which they

play such an important part, is but a battle by which they protect the organism against injurious agents, such as microorganisms. The researches of Metschnikoff, Lavdowsky, and others, have so materially widened our conception of the functions of the colorless corpuscles, that we can regard with equanimity their displacement from the duty so long attributed to them of acting as progenitors of the red corpuscles.

After all, the most solid acquisition to our knowledge of the process of regeneration of the corpuscles is the participation in the adult of the bone marrow, and the development of the red corpuscles from its nucleated colorless cells. Here we seem to tread on a firm pavement of carefully observed and well worked-out facts. There are minor details yet in dispute, which the next few years will see settled. Doubt and uncertainty still exist as to how far, in the adult, the spleen shares in the process, and some good observers (Neumann) would deny altogether the post-natal formation of red corpuscles in it, but I think the evidence is sufficient to show that it shares this important function with the marrow.

We shall find, as our information on the subject deepens, that the regeneration of the corpuscles follows the laws governing the reegneration of tissues in general. In the adult body there are permanent and transitory tissue elements, and to the latter the blood corpuscles undoubtedly belong. The nutrition of the former is entirely interstitial, and does not involve any change in the element, when once fully developed. Of transitory elements the epidermic tissues are the best examples. The epithelium is in constant process of regeneration, and the shedding of the superficial cells is analogous to the destruction of the older red corpuscles. The new growth takes place by the constant fission and multiplication of the cells of the deeper part of the *rete mucosum* and if the entire thickness of a portion of the epidermis is removed by accident, the remnant of the cells adherent to the corium repair the loss. Just so, in the life history of the blood corpuscles, which are fleeting structures, like the epithelial cells, the haematogenous tissues—spleen, bone

marrow, lymph glands—contain as permanent elements cells which, by fission, multiply and pass into the blood current, more or less modified, as the red and white corpuscles.

The recent increase in our knowledge of the changes in the corpuscles in disease, and of the processes of reproduction, is an earnest of fuller information in the near future. A key to the solution of many problems in pathology, will, I doubt not, here be found, but in seeking it let us not forget that the corpuscles float in the blood plasma, the pathological relations of which await investigation, and offer a field for research which should be equally fruitful in advancing our knowledge of the ultimate process of nutrition and of those deviations from it which lie at the very root of so many chronic diseases.

### LECTURE III

#### THE RELATION OF THE CORPUSCLES TO COAGULATION AND THROMBOSIS

I propose, in this lecture, to consider the question of the relation of the corpuscles to the processes of coagulation and thrombosis, and I will first call your attention to the action of the *colorless corpuscles*. Our knowledge of the connection between these elements and coagulation dates from the observations of Buchanan in 1831. He attributed the action of what he called washed blood-clot, in inducing clotting, to the colorless blood corpuscles included in the meshes, and which he said acted as a sort of ferment, comparing the action to that of rennet. These views have been greatly elaborated by Schmidt, of Dorpat, and his pupils, to whose researches we are indebted for an important extension of our knowledge in this department of physiology.

According to these well-known observations, the colorless corpuscles furnish the fibrinoplastin or paraglobulin, and the ferment, while the third element, the fibrinogen, exists naturally in the blood plasma. Schmidt and his pupils hold that, in furnishing these two elements to make up the fibrin, the colorless blood corpuscles undergo disintegration and destruction. Part of the evidence which they bring forward in proof of this is as follows:

The blood plasma of the horse may be readily collected by keeping the blood at a low temperature and allowing the red blood corpuscles to subside, when a clear layer remains, consisting of plasma with a few red and many colorless corpuscles. Now, if a portion of this plasma is taken and whipped with twigs, the difference between the number of colorless corpuscles remaining in the serum and those in the original plasma represents the number of colorless corpuscles which have undergone destruction in the process of the formation of fibrin, and Schmidt and his pupils estimate that at least seventy per cent. of the colorless corpuscles undergo destruction in this way. They found that, instead of 15,000 colorless corpuscles in a cubic millimetre of the plasma before it is whipped—i.e., before the fibrin is extracted—there were subsequently not more than 4000 per cubic millimetre remaining in the serum. Examining the clot so obtained, it is stated that the colorless corpuscles have largely, if not entirely, undergone destruction in the formation of fibrinoplastin and the fibrin ferment. This is, perhaps, the most convincing experiment which any one of Schmidt's pupils has brought forward to sustain the view, that colorless corpuscles undergo destruction in the process of coagulation. There are many other points urged by Schmidt to which I need not refer, as they are readily accessible in the works on physiology.

The researches of Wooldridge<sup>1</sup> have also shown that the colorless corpuscles play an important part in the formation of fibrin. He has been able to procure leucocytes from lymph glands in a tolerably pure condition, by means which he has described at length in his paper. These leucocytes when added to an equal volume of a ten per cent. solution of common salt seem to be converted into a material resembling very closely ordinary fibrin. By experimenting with what is known as peptone plasma he has obtained very striking results which would appear to indicate still more clearly that leucocytes play an important part in this process. Peptone plasma is obtained by injecting peptone into the blood vessels and then bleeding the animal. Coagulation is

<sup>1</sup> Proceedings of the Royal Society of London, 1881.



prevented entirely by the influence of peptone, and the red blood corpuscles may be entirely removed from the serum by the centrifugal machine. This plasma shows no special inclination to coagulate, and is, of course, particularly suitable for experimental purposes. If the leucocytes prepared from the lymph glands be added to this plasma, coagulation at once occurs. If a small quantity of leucocytes is added, the amount of fibrin produced is small; if a larger quantity is added, more fibrin is produced. In fact, Wooldridge has shown that the amount of fibrin produced in the peptone plasma is directly proportionate to the leucocytes added. Moreover the albumins in the peptone plasma, after coagulation, can be shown not to have undergone any change, but remain the same, quantitatively and qualitatively; and a third point is that the leucocytes appear to have undergone disintegration.

There are other points in Wooldridge's researches to which I shall not have time to refer at length, but he concludes that it is only the dead plasma which converts the cells into fibrin, as the injection of leucocytes into the blood of the living dog produces no effect.

Such facts appear to show very conclusively that the corpuscles do undergo disintegration, and yet if the blood plasma of the horse is examined after it has been whipped leucocytes may be found in the serum and also in the clot which has been produced, so that all the leucocytes have not undergone destruction. The existence of a certain number of the leucocytes after clotting has occurred has caused one of Schmidt's pupils, Heyl,<sup>1</sup> to divide the leucocytes into two sets: the alpha-leucocytes, (p. 422) which undergo destruction during clotting; and the beta-leucocytes, which remain. From observation, I do not believe that the number of the leucocytes which undergo disintegration in the clotting of the horse's blood is anything like so extensive as Heyl states.

Although the evidence in favor of the destruction of the colorless elements seems conclusive, yet, if the fibrin formation is studied under the microscope, it appears to take place without

<sup>1</sup> Dorpat Dissertation, *Fortschritte der Medicin*, 1883.

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any disintegration of colorless corpuscles, and it is extremely difficult to demonstrate their participation in the process. As is well known, it can be studied in a blood-drop examined in the ordinary way, or better still, in the moist chamber. The time which elapses before coagulation begins is variable in different individuals and under different conditions. Usually, however, from fifteen seconds to two or three minutes elapse before the first appearance of the fibrin filaments is noticed. A slide can be prepared in a very few seconds, and there is sufficient time before clotting begins to examine the colorless corpuscles, the red corpuscles, and the blood plaques. I must say that, in a very careful examination of the process of the formation of fibrin in this way, I have never seen any appearance in the leucocytes which would indicate that, as the fibrin was formed, they underwent disintegration or dissolution. On the contrary, they seem most stable elements, and the amoeboid movements persist long after the fibrin network is thick and dense in the field. Certainly in the microscopical examination of the ordinary slide, or in the examination of the blood-drop in a moist chamber, I do not think anyone has seen the direct disintegration of leucocytes in the production of fibrin. An interesting and instructive experiment is to draw the blood of a frog, or of the horse (in which Schmidt and his pupils hold that the colorless corpuscles so rapidly undergo disintegration), into a fine capillary tube in which the process of clotting can be watched under the microscope. At first, the entire tube is filled with corpuscles; but, before long, it is seen that the clot contracts, and there is a peripheral layer of serum squeezed out. In a short time, leucocytes can be seen emerging from the clot in numbers, either squeezed out or migrating from it. This experiment, which can be readily demonstrated, forms an admirable mode, as Schafer showed some years ago, of studying the process of coagulation.

A study of the histogenesis of fibrin as seen in the moist chamber, in the capillary tube, and on the ordinary slide, affords, I think, no evidence in favor of the destruction of the colorless corpuscles, but, on the contrary, is directly opposed to this view. In a certain number of instances the aggregations of blood

plaques, to the connection of which with the process of coagulation I shall shortly refer, have possibly been mistaken for colorless corpuscles.

The relation of the *red corpuscles* to coagulation is not regarded as very important; they play a more passive part. But Landois and others have described a process which can be readily seen in the blood of the frog and in mammalian blood, examined in serum. If we take the blood of the frog and examine it in the serum of the blood of the rabbit, it will be seen that the red corpuscles of the frog crowd into columns, and in a short time the haemoglobin leaves the corpuscles, which become granular, and fibrin filaments form in their vicinity, and according to Landois, the red corpuscles break down into a material which resembles granular fibrin very closely, indeed. These observations were made ten or eleven years ago by Landois, and they have been confirmed by others; but whether the corpuscles undergo transformation into the fibrin filaments, or whether fibrin only clots about these groups of corpuscles under the influence, perhaps, of a ferment which they extrude, it is impossible to say.

The relation of the *blood plaques* to coagulation is particularly interesting, and is, at present, attracting a great deal of attention.

In the study of fibrin formation, as seen under the microscope, it has long been noticed that the fibrin filaments spread out as distinct rays from the minute aggregations which have been known as Schultze's granular masses. Schultze noticed these, as did also Ranvier, in 1873, who regarded these masses as centres of coagulation. That the fibrin sets in a thick, dense network about the plaques is readily seen, but it can also be noticed, particularly if healthy blood is examined in which the plaques are not very numerous, that the fibrin also appears quite independently of the plaques. It forms as distinct little needle-shaped bodies presenting an appearance not unlike that of crystals. That these crystal-like portions of fibrin appear in regions of the field quite apart from the blood plaques, is well seen in studying the process of coagulation in the moist chamber. Although the fibrin needles when first formed may appear in portions of the field unoccupied by blood plaques, yet the network is usually most

dense in their neighborhood, and when the entire field is covered with fibrin filaments, the disintegrated blood plaques look like centres from which the filaments radiate.

The relation of the blood plaques to coagulation, as examined experimentally, is even more interesting. If an ordinary ligature is passed through the femoral vein of a dog and allowed to remain for five or six minutes, or even less, the threads become coated with the plaques, as represented in Fig. 1. It is well to separate slightly the filaments of the thread, and if exposed to the blood stream for as long as ten minutes they become uniformly beset with the plaques. A few white corpuscles may be entangled among them, but undoubtedly the plaques are the first elements to aggregate about such a foreign body. The outlines are usually distinct, but if allowed to remain long in the vein those nearer the threads become more granular, and the distinct corpuscular nature is less evident. If a small brush of thread is tied to the end of a pen-handle, or any suitable object, then whipped in the blood, as freshly drawn, for four or five minutes, and then examined, the brush of threads will have precisely the same appearance, and are uniformly covered with blood plaques. The colorless corpuscles are adherent here and there, but the blood plaques form the striking elements. They adhere to the filaments of the thread, and several of the finer (p. 423) fibres of the thread may be entirely agglutinated by the aggregation of the blood plaques about them. I can fully confirm these original observations of Bizzozero and Hayem, and the experiments have now been repeated by a number of observers. If the threads, after having been whipped in the blood, are carefully washed in a saline solution, all the red corpuscles can be washed away, so that few, if any, can be seen, and then if these threads are dipped into a coagulable solution, clotting will occur. This experiment was performed by Bizzozero in 1882, and has been repeated by other observers. It has been urged against it that possibly the threads beating about in the blood have absorbed some of the fibrin ferment. This is, of course, possible, but certainly in such threads the chief elements to be seen are the blood plaques, and the leucocytes are very scanty; besides, the greater the number of the blood plaques

adherent to the thread the denser the coagulum will be, as if the blood plaques furnished the material for the production of the fibrin or the ferment in large quantity.

Still more conclusive evidence of the participation of the blood plaques is their relation to thrombi, as experimentally produced.

The femoral artery of a dog is exposed and a linear slit made in the vessel, through which the animal is allowed to bleed to death. This portion of the vessel is rapidly excised and placed at once in alcohol, or, still better, first in osmic acid, and then sections carefully cut through the part where the incision was made, when such an appearance as seen in Fig. 2 will be found. Occupying the cut edges, and filling in places the lumen of the vessel a finely granular material is seen under a low power. Surrounding it, to the outside, as represented at 5 in the figure, there is a darker material made up largely of dark clots composed of red blood corpuscles. In the central portion, in immediate contact with the cut edges of the vessel, in contact with the elastic lamina of the intima, and occupying the interstices of the ragged surfaces, are the blood plaques. This was so stated by Bizzozero in 1882, and it has been confirmed in an elaborate investigation from the laboratory of Langhans,<sup>1</sup> in Berne. My own observations are in harmony with these, and we may say that the plaques are the elements which first settle on the edges of a wounded vessel and which form the basis of the thrombus.

Fig. 3 represents the end of a portion of the adventitia indicated by a cross (X) in Fig. 2. The sketch shows the blood plaques in a condition of granular disintegration, but under a high power the outlines can be distinctly defined, and any one with a knowledge of these elements and of the changes they undergo has no difficulty in recognizing them. If the cut ends of the vessel are examined when fresh, in osmic acid or Pacini's fluid, the elements are still more clearly seen and are readily determined to be identical with those in the circulating blood and in the granule masses. The elaborate investigations of Eberth, published in the January number of Virchow's *Archiv*, 1886, clearly demon-

<sup>1</sup> Lubnitzky, *Archiv. f. Exp. Path. u. Pharm.*, 1883.

strate that the plaques are the first elements to settle and lodge on the lacerated portion of the vessel or on a portion of vessel destroyed by acid or by caustic.

The relation which the blood plaques bear to the so-called white thrombi is particularly interesting. Zahn<sup>1</sup> appeared to prove by his observations that white thrombi are composed exclusively of colorless corpuscles, and the current idea is that to a lacerated portion of a vessel the colorless corpuscles adhere and undergo disintegration, become granular, and form in this way a white thrombus. Bizzozero, Hayem, and Eberth have shown, I think pretty conclusively, that if a needle is passed across a vessel in the omentum or in the mesentery, so as to injury it, the first elements which are collected at the site of the injury are not the colorless corpuscles, or the red corpuscles, but the blood plaques, which form (p. 423) distinctly aggregated masses—white thrombi. There may be colorless corpuscles as well, but the chief bulk of the thrombus, which has formed at the site of the injury, is undoubtedly made up of blood plaques.

A study of white thrombi as met with in man leads us to the same conclusion. These structures have been long recognized, and have been supposed to be made up largely of colorless corpuscles. We find them on atheromatous ulcers, forming thrombi in the femoral veins, in the auricles and the ventricles, on the valves in endocarditis and as the lining of aneurismal sacs. The examination of the superficial part of a white thrombus in osmic acid, Pacini's fluid, or even salt solution, reveals the fact that it is composed of blood plaques. In the peripheral part where they have not undergone disintegration, such thrombi are, so far as my observation goes, without exception, made up of small circular, disk-like elements which any one familiar with the blood plaques will readily recognize as such. Fig. 5 represents two or three white thrombi in the aorta immediately above the bifurcation. The case was one of cancer of the stomach, and when the aorta was slit open these masses were seen looking as if a neoplasm from the retroperitoneal glands had perforated it. They were

<sup>1</sup>Virchow's Archiv, Bd. 62.

grayish-white in color, soft, and on examination were seen to be composed of the elements shown at Fig. 6. There could be no doubt as to their nature; they were blood plaques, presenting the circular appearance, and on profile, the narrow linear aspect of these bodies. This was the first specimen in which I was able to demonstrate that the white thrombi were made up of the blood plaques. Since then many specimens have fallen under my observation, particularly in connection with vegetations on the valves of the heart, the thrombi in aneurisms, and upon atheromatous ulcers. I would ask those specially interested in the question carefully to observe the white thrombi, more particularly the superficial parts of them in contact with the blood current. I think they will find that, without exception, they are composed not of colorless corpuscles, nor of a reticulated fibrin network, but almost exclusively of these plaques which, in the deeper parts, have undergone granular disintegration, but in the superficial parts still retain their normal shape and appearance.

The observation that these white thrombi consisted of blood plaques was confirmed in 1882, by Bizzozero, and, in the same year by Hayem, and since then it has been noted by a number of observers.

Fig. 7 represents a small aneurism of the thoracic aorta, which shows on its lining membrane a number of soft grayish-white curvilinear elevations, such as all observers have noted. On examination these will be found to be made up of elements similar to those which compose the white thrombi, namely, distinctly circular, disk-like blood plaques. The changes which these bodies undergo are very peculiar. As I mentioned in my first lecture, they appear in masses as soon as they (p. 425) are withdrawn, and then undergo remarkable transformation, whereby they lose their outline and become converted into a granular material in which the individual plaques become unrecognizable. That change occurs in the blood plaques as they form these white thrombi. In the deeper portion of the thrombus, represented in Fig. 5, the blood plaques had disintegrated and become granular and were no longer distinctly recognizable; but at the superficial part they were distinct, their outlines were well marked, and in

osmic acid, in teased preparations, distinctly made out and readily preserved.

Eberth's researches are of special value in this connection, and appear to place the experimental evidence of this important point on a firm basis, and explain the production of white thrombi. In the rapidly circulating blood, the central portion of the vessel is represented by a dark line in which you see no corpuscles whatever; nothing but a red streak, on either side of which there is the so-called still layer, with an occasional leucocyte. This represents the blood current in its active rapid condition. If the circulation becomes slower, then it is seen that, in addition to the leucocytes which collect in the still layer, the blood plaques appear; but in the rapidly circulating blood, as seen in the mesentery or the omentum of the guinea-pig or the rabbit, the still layer, the peripheral portion, contains no blood plaques, and only occasionally a leucocyte—in fact, the corpuscles are separated from the wall of the bloodvessel by a distinct tube of plasma.

Eberth brings forward these facts in explanation of the development of white thrombi. So long as the circulation is active the plaques remain central, and adhere neither to each other nor to the vessel wall; but when, from any cause, the current is slow, this natural disposition of the corpuscles is disturbed, and the plaques tend to collect at the periphery, and aggregate in groups at any point which has been injured, or which has been deprived of the endothelium. Slowing of the blood stream is then, on this view, one of the essentials in the formation of white thrombi, and this is entirely in accord with what we know of the pathology of these structures. It is not alone the presence of intact endothelium which prevents the formation of thrombi in the vessels, for we frequently find in aneurisms, on the heart valves, and on the aorta, denuded and rough regions upon which thrombi do not form. Indeed thrombi are not often found on atheromatous ulcers, which would offer the favorable localities for their formation if it is the epithelium alone which prevents it. The other condition would appear to be slowing of the blood stream, which has long been known to play such an important part, and the true significance of which is well seen in the light of these observations of Eberth.



What I contend is, that the white thrombi are composed chiefly of plaques, and that the colorless corpuscles play an altogether insignificant part in their formation, and the experimental evidence which has been offered is borne out completely by a study of morbid anatomy.

The further development of the thrombus results from the disintegration of the plaques, and the formation of a finely granular material in which there may be no fibrin filaments. We must recognize a granular or stroma fibrin, as Landois calls it, and a fibrillar or plasma fibrin. The former is a granular material which develops when cells undergo the peculiar metamorphosis described by Weigert as coagulation-necrosis, and it is this in reality which goes on in the white thrombi. There may be no trace of fibrin filaments, but the chief mass is made up of a granular matrix in which the outlines of the plaques are no longer visible. The stages of this transformation I have traced in thrombi of the femoral vein, and it is well seen in passing from the superficial parts to the deeper parts. The plaques on the surface of a white thrombus, as at Fig. 5, may be intact, or they may show signs of disintegration and conversion into granular debris. The central softening of a white thrombus results from the liquefaction of the plaques, and is a result possibly of the presence of fluid in greater abundance than is necessary for the process of coagulation-necrosis. Quite recently in a case of typhoid fever, I had an opportunity of studying the histological characters in thrombi in the femoral veins. In both they were mural, and had originated behind the valves. The attached portion was a light brown-red color, but the upper half was of a dead-white color, and the extension into the iliac was of the same character. The line of demarcation between the two parts was pretty clearly defined. At the thickest portion the superficial white thrombus had softened to an opaque milky liquid, but at the prolongation it was firm and consistent. A few colored and colorless corpuscles were scattered through the white thrombus, but the great mass of it was composed of blood plaques, and a study of the softened milky region showed clearly that the granular detritus was composed of the altered plaques. In the deeper parts the plaques became less

and less distinct, until a point was reached at which the individual cells were no longer visible, and there was nothing but an indifferent matrix. The contrast in color between the outer and inner portions indicated a difference in age, possibly in mode of formation, though in the outer portion of the brown and the inner part of the white, close to the line of demarcation, the structure seemed identical.

In the light of these new observations on the connection of the blood plaques with thrombi, the entire question may be restudied with advantage, particularly the relation of the white and mixed thrombi, and the mode of formation of the clot in aneurisms. Of the truth of the statements here made regarding the connection of the plaques with thrombosis, I feel assured from careful observation on the structure of the white thrombi, (1) on atheromatous ulcers, (2) on the valves of the heart, (3) in aneurisms, and (4) in thrombi of the veins. I have not lately had an opportunity of examining a "globular vegetation" of an auricle or ventricle, but I venture to state that they are composed originally of similar structures.

THE END

## PLATE I

Fig. 1. a. Aggregations of plaques in human blood, forming the so-called *granule masses* of Max Schultze. b. Disintegration of the plaques, with fibrin filaments and mucin-like spheres adhering to the mass. c. Isolated plaques.

Fig. 2. Plaques in circulating blood, omentum of guinea-pig. 18, 1, '83.

Fig. 3. Plaques in small artery from subcutaneous tissue of scrotum of man, one hour after removal. Case of elephantiasis. 20, 11, '85. They had collected in numbers at this portion of the vessel.

Fig. 4. Isolated plaques in normal blood. Osmic acid 1 per cent.; one-twelfth im. (Zeiss). a. Red corpuscles. b. A white corpuscle. c.c. Plaques with slightly irregular margins. d. Plaque with faint granular appearance in centre as if nucleated.

Fig. 5. a. Changes in appearance of the plaque, due to separation of its protoplasm into a darker and clearer portion. b. Alterations in form of plaques, examined in blood-serum and watched for three hours.

Fig. 6. Alterations in the plaque while within the bloodvessels, sketched after three hours on the warm stage. 6, 4, '73.

FIG. 1.

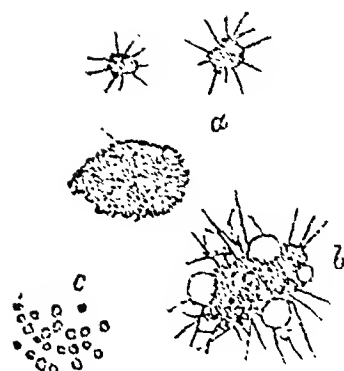


FIG. 2.

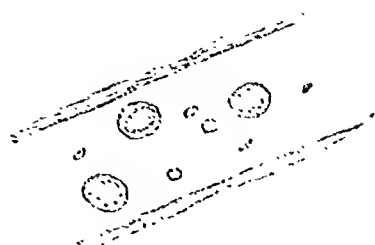


FIG. 3.

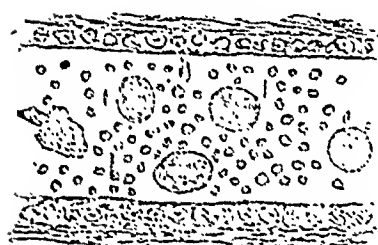


FIG. 4.

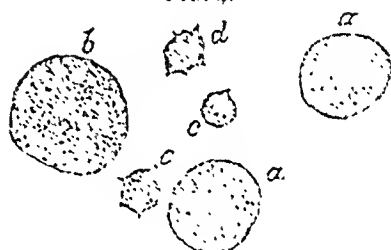


FIG. 5.

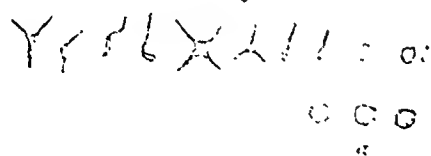
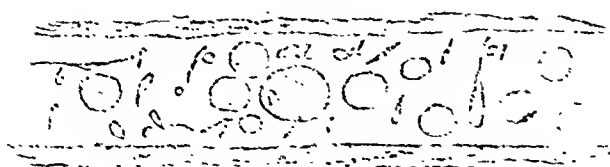


FIG. 6.



## PLATE II

Fig. 1. Outlines of red corpuscles in a case of profound anaemia. 1. Normal corpuscles. 2. Large red corpuscle—megalocyte. 3, 3. Very irregular forms—poikilocytes. 4. Very small, deep red corpuscles—microcytes.

Fig. 2. Extreme poikilocytosis in blood from anaemic patient, examined Pacini's fluid. It illustrates also a possible mode of origin of the microcytes.

Fig. 3. Origin of microcytes from red corpuscles by process of budding and fission. Specimen from red marrow.

Fig. 4. Nucleated red blood-corpuscles from blood in case of leukaemia.

Fig. 5. Corpuscles containing red blood-corpuscles. 1. From blood child at term. 2. From blood of a leukaemic patient.

Fig. 6. a. 1, 2, 3. Spleen cells containing red blood-corpuscles. b. From marrow; 1, cell containing nine red corpuscles; 2, cell with reddish granular pigment; 3, fusiform cell containing a single red corpuscle. c. Connective tissue corpuscle from subcutaneous tissue of young rat, showing the intracellular development of red blood-corpuscles.

Fig. 7. Cell elements of red marrow. a. Large granular marrow cells. Smaller, more vesicular cells. c. Free nuclei, or small lymphoid cells, some which may be evenly surrounded with a delicate rim of protoplasm. d. Corpuscles with clear, translucent protoplasm.

Fig. 8. Nucleated red cells of marrow, illustrating mode of development in the ordinary non-nucleated red corpuscle. a. Common forms of the color nucleated cells of red marrow. b. 1, 2, 3. Gradual disappearance of the nucleus. c. Large non-nucleated red corpuscle resembling 2 and 3 of b, in all respects save in the absence of any trace of nucleus.

Fig. 9. Nucleated red corpuscles, illustrating the migration of the nucleus from the cell, a process not infrequently seen in the red marrow.

Fig. 10. Blood of embryo, four months. a. 1, 2, 3, 4. Nucleated red corpuscles. In 4 the same granular disintegrated appearance of the nucleus as marrow cells. b. 1, microcyte; 2, megalocyte; 3, ordinary red corpuscle.

Fig. 11. From spleen. 1. Blood plaques, colorless and varying a little size. 2. Microcytes of a deep red color. 3. Two ordinary red corpuscles. A solid, translucent, lymphoid cell or free nucleus.

FIG. 1.

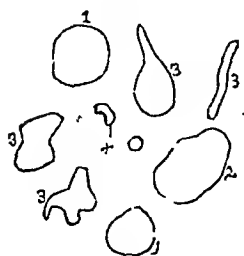


FIG. 2.

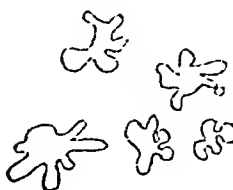


FIG. 3.

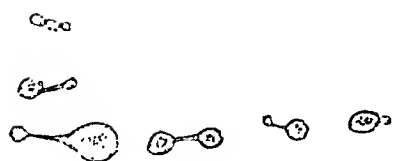


FIG. 4.



FIG. 5.



FIG. 6.

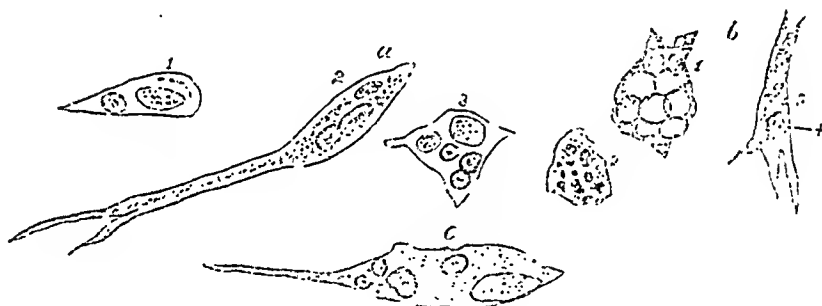


FIG. 7.

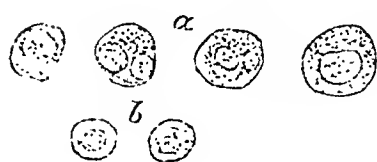


FIG. 8.



FIG. 11.

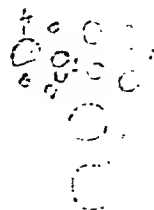
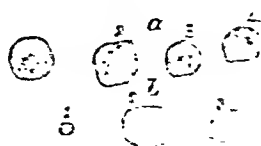


FIG. 9.



FIG. 10.



## PLATE III

Fig. 1. Aggregation of plaques on a thread of cotton passed through femoral vein of dog and allowed to remain ten minutes.

Fig. 2. Section of femoral artery of dog at the site of longitudinal incision through which the animal bled to death. (Cut rather obliquely, low power.) 1, 2, 3. Adventitia, media, and elastic lamina of intima. 4. Aggregations of blood plaques in enormous numbers about the intima and the cut margins of the vessel. 5. Clot composed chiefly of red corpuscles. 6. The cut end from which Fig. 3 was sketched.

Fig. 3. End of small portion of adventitia indicated at 6 in Fig. 2. The fibres are everywhere surrounded with granular disintegrating plaques.

Fig. 4. Plaques from thin clot on warty endocarditis.

Fig. 5. White thrombi composed almost entirely of blood plaques. Abdominal aorta. Woman dead of cancer of the stomach. From specimen in Museum of McGill Medical Faculty, Montreal.

Fig. 6. Plaques from specimens illustrated in Fig. 5.

Fig. 7. Small aneurism of thoracic aorta, showing the internal wall of the sac covered with numerous curvilinear elevations, grayish-white in color, and composed of blood plaques. Specimen in Museum of McGill Medical Faculty, Montreal.

FIG. 1.

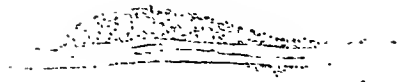


FIG. 2.



FIG. 3.



FIG. 4.



FIG. 5.



FIG. 7.

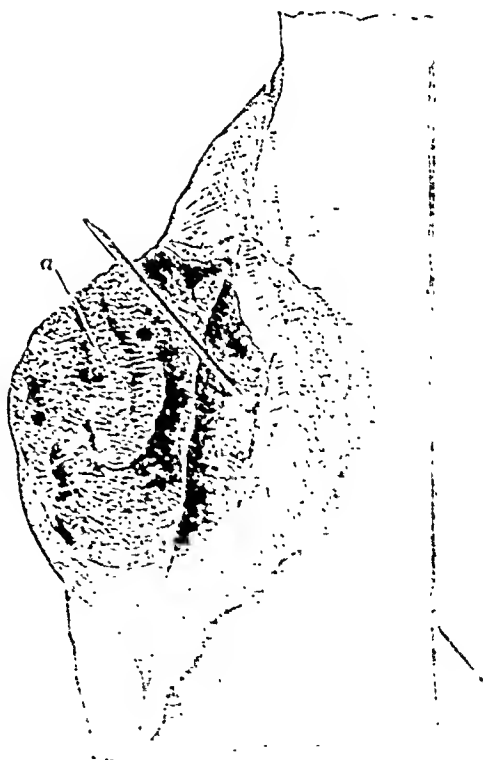
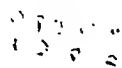
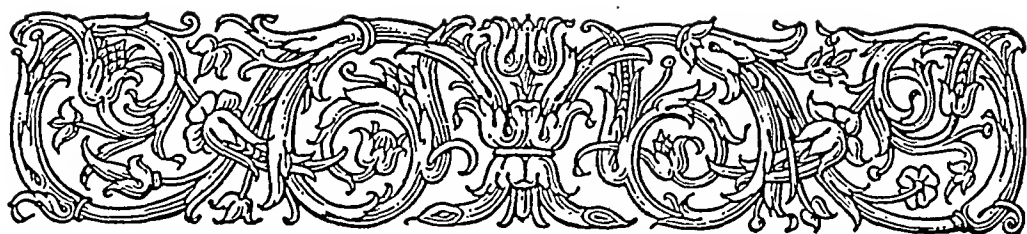


FIG. 6.







# A Clinical Lecture on The Ball-Valve Gall-Stone in the Common Duct

BY

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**G**ENTLEMEN,—I will begin this lecture by showing you two interesting specimens. The first consists of the stomach, duodenum, and liver. Even from a distance you can see a nodular projection beneath the mucosa of the duodenum. On closer inspection this is seen to correspond to the papilla biliaria, the orifice of which lies a little to the side of the most prominent part of the projection. This nodular body is a hard, firm mass which can be moved up and down, and as I make it appear at the orifice of the duct you see that is a rounded, dark gall-stone much too large to escape. On moving it up and down it cannot be passed out of the duodenal portion of the duct, but in this it has considerable play. On examining from the side of the duct the stone is seen to lie in a greatly distended diverticulum of Vater. The common duct is of

about the size of my index finger, and the main hepatic ducts are also dilated. The cystic duct is wide, and the gall-bladder is perhaps a little enlarged. It did not at the time of the necropsy contain any stones. The dilated bile-ducts and the gall-bladder contained bile-stained mucus. There was neither erosion nor ulceration in the bile passages. I have kept this specimen carefully for nearly ten years, and have frequently demonstrated it to classes of students. The history of the case is very instructive, particularly in connexion with the patient whom you will see in a few minutes.

In September, 1887, when I took charge of certain of the medical wards in the Philadelphia Hospital, there was a woman, aged forty years. It was the third or fourth time she had been admitted, each time with chills, fever, and jaundice. The attacks had recurred on and off for two years, during which period she had not passed two months without some tinge of icterus. The case had excited a good deal of attention, and I remember that in 1886 Dr. Bruen brought to me some of her blood to examine for the malarial parasites. The diagnosis of abscess of the liver had been made on several occasions, and the liver had been twice aspirated. When she first came under my care she was up and about in the ward, and showed only the slightest lemon tint of the skin and of the conjunctivae. The stools were dark coloured. The liver appeared to be a little enlarged; the gall-bladder could not be felt. Early in October she had an attack of violent pain with vomiting and a moderately severe rigor, after which the temperature rose to nearly  $104^{\circ}\text{F.}$ , with ephidrosis, the entire paroxysm lasting for more than twelve hours. The following day she was much more jaundiced, the urine was very dark in colour, and the stools were putty-like. The liver was sensitive on pressure; the gall-bladder could not be felt. The jaundice deepened for three or four days and then gradually became less marked. Throughout the winter at intervals of a few weeks she had four or five attacks of a similar character. I lectured upon the case as one of Charcot's hepatic intermittent fever, due probably to a gall-stone lodged in the common duct, to which opinion I was led from the study of cases which I had seen in Montreal. Early

in February I asked Dr. White to see the patient, and she consented to an operation. Perihepatitis was found at the margin of the liver, the gall-bladder was not enlarged, and no gall-stones could be felt in the gall-bladder or in the duct. Three days subsequently she died from peritonitis.

Naturally I was much chagrined at the negative result of the operation. A necropsy was refused, and the friends removed the body to the country, but a personal interview enabled me to procure an examination, and I was allowed to remove the organs which you see before you for careful dissection. This patient had had for a period of nearly two and a half years attacks of jaundice with chills and fever—a very characteristic picture of the intermittent hepatic fever which Charcot and others have so fully described.

The second specimen is an almost exact counterpart. Projecting from beneath the mucous membrane of the duodenum close to the papilla biliaria is a nodular body of the size of an almond which can be pushed down to the orifice of the duct, when it is seen to be an oval gall-stone lying in the diverticulum of Vater, in which it has a certain degree of mobility. At the necropsy in this case it was very interesting indeed to note that on firm pressure on the gall-bladder bile could be forced past the stone into the duodenum. Both cystic and the common ducts are dilated to about the size of the little finger. The gall-bladder is of the size of a small pear. There is no other gall-stone. The contents of the common and cystic ducts were thin, yellow bile containing some dark granular matter. The colon was adherent to the gall-bladder and to the under surface of the liver. The liver weighed 1570 grammes; the surface was a little roughened. The cut section was bile-stained and showed moderate dilatation of the smaller ducts. The consistence of the organ was increased. It may be mentioned also in connexion with the case that there was a chronic diffuse nephritis. The further details of the necropsy, which is No. 758 in the Johns Hopkins Hospital Records, do not concern us. The history of this case has not quite the same interest as the other, but it presents identical features.

The patient was a man, aged sixty years, who was admitted to

the hospital on Dec. 22nd, 1895. I had seen him on Nov. 23rd previously and had learned that he had been ill for rather more than three months with recurring attacks of slight jaundice and paroxysmal pain in the right side, which were sometimes accompanied by chills and fever. When I saw him he was slightly jaundiced, there was much irritability of the stomach, the liver was not enlarged, and the gall-bladder could not be felt. The condition had varied very much from time to time, being sometimes better and sometimes worse. He had had numerous attacks of chills and fever, following which the jaundice would become more intense. He had been actively treated for malaria. He grew progressively weaker, and when admitted to the hospital on Dec. 22nd he was very feeble and apathetic. He had a sallow, slightly jaundiced colour, with distinctly jaundiced conjunctivae. The pulse was 106; he had no fever. His temperature at 4 A.M. on the 23rd was normal. He shortly afterwards had a chill, and by noon his temperature had risen to nearly 103°F. He had a great deal of pain in the right side of sufficient severity to require morphia. Ephidrosis followed the fever, and the patient seemed to be somewhat more jaundiced. There was a small amount of albumin in the urine with granular casts and a distinct reaction of bile pigment. He became much more prostrated after this attack, had a good deal of pain at intervals, and was drowsy and apathetic. On the night of the 30th he had a severe attack of general convulsive twitching, and a slight rise in the temperature with ephidrosis occurred on the 31st. On Jan. 2nd he had Cheyne-Stokes respiration, became unconscious, and died on Jan. 4th. In this case the attacks of pain and intermittent paroxysms of fever enabled me to make a very positive diagnosis of a gall-stone in the common duct.

The consideration of these two cases and the inspection of the specimens will enable you to appreciate better the symptoms presented by the case which I will now ask to have brought into the lecture-room. The history of this patient, as taken by Dr. Gwyn, is as follows:—

A married woman, aged twenty-eight years, was admitted to the hospital on Nov. 28th, 1896, complaining of pain in the epi-

gastrium. She had been a very healthy woman and had had two children. In July, 1894, she had a miscarriage. The first attack of her present trouble (in September, 1894) came on with vomiting, headache, and pain in the abdomen. The skin at this time was very sallow, but she did not think she became jaundiced. The urine was of a dark colour. She had distinct chills, severe and shaking. After an illness of three weeks she recovered and remained quite well until June, 1895. In this second attack she had nausea and vomiting, itching of the skin, jaundice, chills and fever, and pain in the epigastrium. It lasted about four weeks. The third attack was in September, 1895. She had, however, no paroxysm of pain, but she had chills at intervals, and there was slight tingling of the whites of the eyes. Recurring attacks of chills and fever persisted until Christmas. The fourth attack came on in March, 1896. It began with nausea, vomiting, and pain in the epigastrium and under the right costal margin (p. 1320) passing back to the right shoulder. She became very jaundiced and had much itching of the skin. The pain was much more intense than in any previous attack, and she had to have morphia. She had recurring chills and fever, and the jaundice persisted for nearly three months. The fifth attack, for which the patient came to the hospital, began on Sept. 1st with nausea, occasional vomiting, headache, itching of the skin, deep-coloured urine, and slight tingling of the conjunctivae. She had no pain in this attack, but frequent chills recurred until a week before admission to the hospital. The jaundice had been very slight. The chills had been the same in all the attacks. They came on every few days, sometimes quite regularly every other day, lasting fifteen or twenty minutes, and were followed by high fever and occasional ephidrosis. On admission the patient was found to be a well-nourished, healthy-looking woman. The skin was a little sallow, not distinctly jaundiced, and the conjunctivae were slightly tinged. There was nothing abnormal on examination of the chest. The abdomen was a little full, tympanitic, with no areas of abnormal resistance. The liver dulness began at the sixth rib in the nipple line and barely reached the costal margin. The edge of the liver could not be felt. There was no

tenderness on deep pressure in the epigastric region. The gall-bladder was not palpable. The spleen could not be felt. On Nov. 30th the yellow colour of the skin was more marked, and there was bile reaction in the urine. The stools were light in colour. On Dec. 4th there was a little tenderness in the right hypochondriac region, and the patient had had slight pain in this region on the previous day. She remained in hospital until Dec. 6th. She had no chills, and the temperature was under 100°F. The jaundice had almost disappeared and she had gained in weight. She felt well until the day before Christmas, when she became nauseated and was sick at her stomach. On Christmas eve she had a violent chill with high fever and pain of such severity in the region of the liver as to require a hypodermic injection of morphia. The jaundice was intensified the following day and increased considerably. She returned to-day (Jan. 22nd, 1897) to report upon her condition. You see that she is a healthy-looking woman, well nourished, and were it not for the very slight jaundice persisting nothing special would be noted about her. The abdomen is full, a little large, and the panniculus is well preserved. Palpation in the liver region is negative. There is no pain on deep pressure. The edge of the liver cannot be felt, and the gall-bladder is not palpable. Within two years and four months this patient has had at least six attacks of pain in the region of the liver, with chills, fever, and jaundice. The latter has been a variable symptom, sometimes very intense, but if we may judge from her condition on admission on Nov. 28th, 1896, even in the intervals the jaundice does not entirely disappear.

We do not know what starts a stone on its migrations. In a large proportion of all cases so long as the calculi remain in the gall-bladder they do little or no harm. This statement is borne out by the frequency with which gall-stones are found post mortem in persons who have presented no symptoms whatever and whose gall-bladders show little or no change. Once started, a stone has two main obstacles to overcome. The cystic duct is not a simple tubular structure, but has a very remarkable reduplication of its mucosa known as the Heisterian valve. If you attempt to pass a probe or a pair of probe-pointed scissors into the

cystic duct you will find that the point is interrupted by valvular folds which sometimes encircle the entire tube and are very much like the *valvulae conniventes*. Sometimes the arrangement is that of a spiral valve. In other cases there is no symmetry whatever, and the valves may have the free edges directed upwards towards the gall-bladder, or downwards towards the common duct. Both at the neck of the gall-bladder and at the junction of the cystic with the hepatic duct the folds may be unusually prominent. No possible arrangement could be more unfavourable for the passage of a gall-stone; a small one may get lodged beneath the valvular folds, indeed I have seen one tucked in beneath the strong fold sometimes present at the neck of the gall-bladder. Biliary colic is probably an expression of the difficulties a stone has in passing through the valvular folds in the cystic duct. Once in the common duct a stone of medium size has little or no difficulty until it reaches the duodenal portion, the anatomical relations of which may for a moment engage our attention. The bile and pancreatic ducts open by an orifice which is smaller than the lumen of the conjoint ducts, and the opening is usually on a prominent papilla on the mucosa of the duodenum. Between the point of junction of the two ducts and the orifice in the papilla biliaria there is a dilatation, the diverticulum or ampulla of Vater. In this part of the duct the ball-valve stone often lodges. The intermittent filling of the gall-bladder almost assumes the existence of a sphincter choledochi, yet no mention is made of such a structure in the text-books (Quain or Henle). Oddi<sup>1</sup> has demonstrated this sphincter in different animals and in man, and Dr. L. F. Barker has been kind enough to prepare for me several specimens by his method which show the fibres very clearly. Doyon<sup>2</sup> claims to have determined the biliary reflex—the afferent fibres pass in the vagus, and the efferent in the splanchnic—and states that stimulation of the central end of the vagus causes contraction of the gall-bladder and at the same time relaxation of the sphincter choledochi. Upon the importance of this sphincter choledochi in the history of gall-stones

<sup>1</sup> *Di una Speciale Disposizione a Sfintere Allo Sbocco del Coledoco*, Perugia, 1887.

<sup>2</sup> *Archives de Physiologie*, January, 1894.

very little stress has been laid, except by Leichtenstern in his recent section on Diseases of the Bile Passages in Penzoldt and Stintzing's "Handbuch."<sup>3</sup> He states that sometimes macroscopically, as well as microscopically, hypertrophy of this sphincter can be seen in old cases of gall-stone impaction. To another point he refers (of great importance in connexion with the condition of the gall-bladder in these cases)—viz, that the physiological filling of the gall-bladder with bile is a function of this sphincter. It is in this duodenal portion that the typical ball-valve stone is most frequently found, as in the two specimens which I have demonstrated to you, though it may lie loose in the duct. Let me call to your remembrance the fact that pressure on the gall-bladder in the second specimen could make the bile flow past the obstructing stone. My attention was first called to this condition many years ago, and in a lecture which I published in 1881,<sup>4</sup> on Some of the Effects of Chronic Impaction of Gall-Stones I remarked "that a gall-stone may remain permanently lodged in the pars intestinalis and yet not be impacted. In such instances it may still permit the passage of bile past it, or it may act as a ball valve, only permitting of the flow when the distension behind has reached a certain point." In several cases the stone in the diverticulum of Vater was so placed that it could be moved up and down to act as a sort of ball valve; and clinically I had had an opportunity of studying two cases (Nos. 11 and 12 of those reported in the lecture) in which the remarkable train of symptoms seemed best explained by this ball-valve action of a stone in the common duct. Subsequently, in a paper on Fever of Hepatic Origin,<sup>5</sup> particularly the intermittent pyrexia associated with gall-stones, I called attention especially to the importance of recognising a group of cases of obstruction of the common duct characterised by the following symptoms: "First, jaundice of varying intensity, deepening after each paroxysm, and which may persist for months or even for years; second, ague-like paroxysms characterised by chills, fever, and sweating, after which the

<sup>3</sup> Band 4, 1896.

<sup>4</sup> Medical Times and Gazette, July 31st, 1881.

<sup>5</sup> Johns Hopkins Hospital Reports, vol. ii., 1890.



jaundice usually becomes more intense; and, third, at the time of the paroxysms pains in the region of the liver, with gastric disturbance." In this paper I considered at length the question of the hepatic intermittent fever which the French physicians, particularly Charcot, had so carefully described, and emphasised the following points: that recovery might follow even, as shown by the cases, after duration of the chills and fever and jaundice for several years; that this condition could be differentiated from suppurative cholangitis; and that the symptoms were probably caused by the ball-valve action of the stone. I added the following statement: "In all of these (p. 1321) cases the obstruction is not complete, as shown by the presence of bile in the stools for long periods at a time. The association of the chills and fever with intensification of the jaundice must be more than accidental. The two must be correlated in some way, in all probability through a transient impaction of the stone in the duct. Such a condition might induce the chill, either through reflex irritation, as held by Murchison, or by preventing the escape from the bile passages of toxic ingredients—ferments produced by the action of micro-organisms—which are absorbed into the blood instead of escaping freely into the bowel. The impaction is probably overcome by a gradual increase in the *vis a tergo* until the duct is stretched to a point which permits the calculus to fall back into a wider portion. The pressure may reach such a grade that the stone is forced out, as happened in Case 2, and very likely in the other cases in which recovery followed." In both editions of my "Textbook of Medicine" I recognised the possibility of diagnosing the presence of the stone in the common duct and of differentiating the catarrhal from the suppurative cholangitis. I had seen many cases which seemed to bear out these statements, and had been in the habit in my classes and at meetings of societies of speaking of the ball-valve action of certain gall-stones. Not having seen my papers, Christian Fenger of Chicago, in the February and March numbers of the American Journal of the Medical Sciences, 1896, made the statement that "neither Courvoisier nor any other author seems to have observed the ball-valve action of floating stones in the common duct."

*Symptoms.*—What are the symptoms of gall-stones in the common duct? They are very variable. There may be none; it may be dilated and full of stones so arranged that the bile can flow past them without much, if any, obstruction. I have twice seen a single small stone in the common duct which had apparently caused no disturbance. No one has laid down more clearly the symptoms of stone in the common duct than Naunyn:<sup>6</sup> “(1) The continuous or occasional presence of bile in the feces; (2) distinct variations in the intensity of the jaundice; (3) normal size or only slight enlargement of the liver; (4) absence of distension of the gall-bladder; (5) enlargement of the spleen; (6) absence of ascites; (7) presence of febrile disturbance; and (8) duration of the jaundice for more than a year.” Now what I wish to bring out in connexion with the case you have just seen is the probable association of the intermittent features—pain, rigors, fever, and jaundice—with the ball-valve action of a stone in the common duct or its diverticulum—a view which offers a reasonable explanation of the remarkable phenomena of the case. This patient when you saw her in the ward looked a well-nourished, healthy woman with only the slightest trace of jaundice, chiefly noticeable in the conjunctivae. Some of you may remember that I predicted another attack as very probable within a few months. In these protracted intervals I take it the gall-stone lies loose in the duct or its ampulla, and the pressure is sufficient to force the bile past it, though the persistence of the slight jaundice for weeks or months shows that the flow is not quite free. The onset of the paroxysms may be due to an acute infection with swelling of the mucosa about the stone and transient complete blocking of the duct, or the stone may be jammed tightly against the orifice of the duct. Impaction would account for the pain and the jaundice; the intermittent paroxysms of fever are probably due, as I suggested in the extract read a few minutes ago, to the absorption by the blood of the toxins produced by the micro-organisms which in the intervals of impaction pass into the bowel. The impaction is followed, of course, by stasis of the bile, a condition very

<sup>6</sup> Klinik der Cholelithiasis, and New Sydenham Society's edition, 1896, p. 107.

favourable to the growth of the micro-organisms. I have recently has occasion to discuss with you the question of infection of the bile passages in a case of typhoid fever with colic and jaundice. Various organisms may be present without doing damage. Thus typhoid bacilli were present in the bile passages of seven persons who died from typhoid fever (seven of fourteen examined) not one of whom had during life given any signs of liver trouble. A stone in the common duct with stasis of the bile and catarrhal cholangitis favours the growth of organisms, which are always seeking entrance—in healthy persons in vain—at the portals of the ducts. Unfortunately in the necropsy upon the case from which the second specimen was obtained, though cultures were made from many parts—as is the custom in the post-mortem room—which were sterile, there is no specific note in the report about the bile passages. Infective cholangitis is present in all these cases, and to it the febrile phenomena are due. The large experience which we are daily receiving from the surgeons should very soon give us positive data as to the varieties of micro-organisms associated with this condition. To one point I would here direct your particular attention—viz., that this infective cholangitis may persist for years without causing suppuration in the ducts or ulceration of their walls. A knowledge of this fact has a very direct bearing on the prognosis and diagnosis of these cases.

*Diagnosis.*—The diagnosis of a stone in the common duct may often be made with reasonable probability, and while the rules laid down by Naunyn could not be bettered I am anxious to go further and to urge the possibility of recognising as a special variety the ball-valve stone. The group of symptoms to which I have referred (and which were shown so graphically in the case of the patient whom you have just seen as well as in those from which the specimens were taken) have not been sufficiently recognised by authors, and when recognised have been too often misinterpreted. Let me again recall them. They are chronic jaundice, rarely deep, varying in intensity, at times almost or entirely disappearing to deepen invariably after a paroxysm (the icterus may be of maximum grade and associated with

intolerable itching); pain, often a constant sense of discomfort, sometimes only an obscure gastric distress, and at others agonising, griping, and like ordinary liver colic; fever, occurring in paroxysms, usually preceded by a chill and followed by sweats, but there may be pyrexia alone; the chills may be quotidian or tertian in type or they may recur for weeks in succession on the same day; the spleen usually enlarges during the febrile paroxysms. Though persisting for months or even for years, the general health may be little, if at all, impaired, and in the intervals between the paroxysms a person may be able to work as usual. The cases are usually diagnosed as chronic malaria, abscess of the liver, or suppuration of the bile passages.

The regularity of the chills and the slight jaundice naturally suggest malaria. In almost every one of my cases the diagnosis of malaria had been made and the patient had been dosed with quinine for weeks or months. In Case 7, a man, aged sixty-four years, who had had jaundice with the intermittent fever, &c., for eleven months, was treated by a well-known Carlsbad physician for malaria, which opinion was concurred in by at least half a dozen physicians in Europe and in this country. The mistake is a very natural one, particularly if the patient has not very intense jaundice. The paroxysm is almost identical in its features with that of simple intermittent malarial fever. The periodicity may be striking, the chills recurring like a tertian or a quartan fever. The good condition in the interval, the absence of great enlargement of the liver or of enlargement of the gall-bladder, and the presence of enlarged spleen are all points which strongly suggest malarial fever. On the other hand, the absence of plasmodia in the blood, the occurrence of pain at the onset of the paroxysm, and the deepening of the jaundice, which is usually of a grade more intense and quite different from the slight subicteroid hue of chronic malaria, should be sufficient to differentiate a case. Cases of simple intermittent fever do not resist the action of quinine. Chronic paludism also as a rule is associated with much more pronounced enlargement of the spleen.

Abscess of the liver can usually be excluded by the absence of tenderness and enlargement, local or general, the variable char-

acter of the jaundice, the good condition of the patient in the intervals of the paroxysms, the very chronic course in many cases, and the absence of progressive deterioration of health and strength. In the case from which the first specimen was taken the diagnosis of abscess of the liver had been made by several physicians, and exploratory punctures had been made on two or three occasions. Her general condition at the end of two years' illness seemed to me to exclude abscess.

As regards suppurative cholangitis, infective processes in the bile passages are very prone to end in pus formation, an only too common sequence of chronic impaction of stone in the common duct. I show you here a coloured drawing of a case of this sort in which you see the stone in the ampulla of Vater; the ducts were enormously dilated, even to the surface of the liver; the gall-bladder was greatly enlarged, full of pus, and the walls ulcerated. Now a majority of writers have (p. 1322) regarded the hepatic intermittent fever as an indication, not simply of infective, but of suppurative cholangitis. In the present case, though the condition has persisted for more than two years, purulent inflammation of the bile-ducts can be positively excluded. When this serious complication is present the symptoms are those of pyaemia of a severe grade. Among the points to be considered are the following: (1) increased tenderness in the hepatic region with possibly enlargement of the gall-bladder, as this is a more common event in suppurative cholangitis than in simple obstruction of the duct; (2) the more frequent return of the paroxysms and, in some instances, the irregularly remittent character of the fever; (3) the jaundice is not so intense in suppurative cholangitis, and we do not see the remarkable deepening in colour after the paroxysms; and (4) the general condition of the patient in the intervals is very different in the two conditions. When suppuration exists there are rarely the prolonged periods of apyrexia, the freedom from distress, and the general betterment which are so well illustrated in the case before you. And, lastly, the time element comes in as an important aid in diagnosis. As I mentioned a few moments ago, the good condition when she was in the ward of the

patient in the present case was quite inconsistent with the idea of a purulent inflammation in the bile-ducts.

The ball-valve action is more likely to occur with a single stone, but the group of intermittent symptoms are not necessarily present. I have reported a case of a man, aged seventy years, who had been jaundiced for several years, but who had not had, as far as could be gathered, attacks of chills and fever. There was a gall-stone in the diverticulum of Vater which could not be pushed into the common duct. There was not, however, complete obstruction, as on squeezing the duct bile-stained mucus flowed from the orifice. A second stone of the size of an olive lay free in the common duct. I cannot speak positively about the clinical features of this case, which I did not see during life. The common duct may be full of calculi and, as is well known, there may be no suspicion of any trouble during life; the bile may flow, as water does in a rocky stream, between the stones. On the other hand, these cases of multiple calculi in the common duct may present marked intermittency in the symptoms. One of the first cases admitted to this hospital was a man, aged sixty-eight years, who had had jaundice of great intensity of three years duration, during which time he had scarcely passed three weeks without a chill of great severity. He died from cholaemia two days after admission. The common duct was distended into a sac and filled with gall-stones. The gall-bladder was shrunken to a small sac tightly contracted around several gall-stones. There was a small ulceration between the duodenum and the common duct. The walls of the ducts were thickened, not ulcerated, and the contents were a viscid, yellowish, non-purulent material. There was an acute ulcerative endocarditis in this case. Other causes of chronic jaundice do not, so far as I know, give this clinical picture. In the pressure of a new growth, as from the pancreas, the jaundice is deeper, more enduring, as a rule, and there are not these singular intermittent features; pain is not so constant a symptom; infection of the bile passages is less frequent; there are often signs of secondary disease; the gall-bladder is enlarged (Courvoisier's rule) and palpable; there is progressive

deterioration of health and strength; and, lastly, there are sometimes the special features of pancreatic diseases—fatty stools, &c.

The presence of the ball-valve stone in the diverticulum of Vater gives a possible clue to the absence of enlargement of the gall-bladder in these cases of obstruction from stone, a point to which a good deal of attention has been paid recently. This interesting observation we owe to Courvoisier, and it is of a good deal of diagnostic significance. Ecklin<sup>7</sup> has recently reviewed the question, and finds that of 172 cases of obstruction of the common duct by calculus in 34 the gall-bladder was normal, in 110 it was contracted, and in 28 it was dilated. Of 139 cases of occlusion of the common duct from other causes the gall-bladder was normal in 9, shrunk in 9, and dilated in 121. It seems quite possible that this absence of dilatation in obstruction by stone is associated with the disturbance in the normal reflex of the sphincter choledochi, an important function of which is, as Leichtenstern states, filling of the gall-bladder.

*Prognosis*—What is the outlook in these cases? Let me give you briefly my personal experience.

Case 1.—This was that of a woman, aged thirty years, in whom for eight months there were recurring attacks of pain with ague-like paroxysms and intensification of the jaundice. The gall-stone passed and the patient recovered.

Case 2.—A woman, aged fifty-five years, from July, 1879, until August, 1882, had jaundice of varying intensity with recurring attacks of pain and intermittent fever. This case was one of unusual severity. Recovery was complete.

Case 3.—A woman, aged forty years, had variable jaundice of two and a half years' duration; there were recurring attacks of intermittent fever with pain; and operation was performed, death ensued, and post-mortem a ball-valve stone was found in the diverticulum of Vater.

Case 4.—A man, aged seventy years, had had jaundice of varying intensity for eleven months; there were repeated par-

<sup>7</sup> *Annales Suisses des Sciences Médicales*, Series iv., Part 3.

<sup>8</sup> These cases have been reported in full in an article on *Hepatic Intermittent Fever*, *Johns Hopkins Hospital Reports*, vol. ii.

oxysms of pain and intermittent fever; death followed from cholaemia.

Case 5.—A woman, aged forty-six years, had been under observation for three years with attacks of pain and intermittent fever with intensification of the jaundice. The patient has been lost sight of.

Case 6.—A woman, aged twenty-three years, suffered from jaundice of ten months' duration varying in intensity; there were paroxysms of hepatic intermittent fever, but the patient recovered.<sup>8</sup>

Case 7.—This was that of a man, aged sixty-four years, who had had jaundice for two and a half years (May, 1890, to November, 1892), with recurring chills and fever with intensification of the jaundice; there was very little pain but great loss of weight. The patient has been in perfect health up to date (January, 1897) since recovery.

Case 8.—A man, aged forty-four years, suffered from intermittent jaundice of many years' (fifteen?) duration; there were innumerable attacks of chills and fever recurring at intervals of from six weeks to six months. Several attacks occurred while under observation in 1892. The patient recovered and has been in perfect health since the spring of 1892.

Case 9.—A man, aged sixty years, had jaundice varying in intensity for nearly six months; there were recurring attacks of pain with chills and fever; death occurred from cholaemia.

Case 10.—A woman, aged twenty-eight years, for two and a half years has had intermittent attacks of jaundice with chills and fever. Her general health has been well maintained. This patient is the one now under observation.

Recovery followed spontaneously in five cases (in one after an indefinite period of years, in one after three years, and in one after two and a half years, and in two cases after eight and ten months respectively), two died from cholaemia, one case was operated on and died, and one was lost sight of. The dangers are suppurative cholangitis, perforation of the duct, diffuse hepatitis, and remotely the development of cancer.

What shall we advise in the present case? The patient's life



has been miserable for more than two years; all sorts of measures have been employed and the Pharmacopoeia has been exhausted. The two remedies which are in vogue at present—phosphate of soda in large doses and olive oil—have been tried in vain. The medicinal treatment of gall-stones is a chapter in our therapeutics the leaves of which are best turned very rapidly. The man who believes he can dissolve gall-stones will probably tell you that he can abort an attack of pneumonia and that he can cure locomotor ataxia. So soon as they give serious trouble their removal by operation is the only rational method of treatment. When they are in the gall-bladder the operation in skilled hands has a minimum of risk. Kehr's recent statistics give one hundred and seven cholecystotomies with only one death. The question is a very different one in the common duct cases. The operation is much more severe, the risks infinitely greater, and the results, even in the best hands, not nearly so good. Kehr has, however, had thirty cases with only two deaths—a remarkable record. In the present case the attacks are recurring with greater intensity and greater frequency, the bile passages have stood the irritation long enough, and I have urged her strongly to submit to an operation at an early date.

A knowledge of the significance of the group of symptoms (p. 1323) to which I have called your attention will suggest to surgeons the advisability of seeking the obstruction in the terminal portion of the duct. In the specimens before you the stones lie in reality within the duodenum, projecting beneath its mucosa, and would be more accessible through an incision in the gut than by a choledochotomy.

THE END



# On a Family Form of Recurring Epistaxis, Associated with Multiple Telangiectases of the Skin and Mucous Membranes

BY

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**T**HE association here described is rare, as, after a careful search through the literature, I can find but one reference to a similar case.

An hereditary form of epistaxis has been well described by Babbington.<sup>1</sup>

The association of epistaxis with angiomas of the nasal septum has long been known; but for the associated condition of multiple telangiectases of other mucous membranes and of the skin, I have been able to find only the following report by Rendu.<sup>2</sup> A man aged 52, whose father had had (p. 334) repeated attacks of melena, and whose mother had been subject to epistaxis, was admitted in a condition of profound anaemia, having had for three weeks a daily recurrence of epistaxis. He had had his first attacks of bleeding from the nose at the age of twelve, and had been subject to them ever since, particularly in the spring.

<sup>1</sup> Lancet, 1865, ii, p. 362.

<sup>2</sup> Gaz. des Hôpitaux, 1896, p. 1322.

He had never had any other haemorrhages. On the skin of the nose, of the cheeks and of the upper lip there were numerous small red spots due to dilatation of superficial vessels of the skin. Similar small telangiectases were seen on the internal surfaces of the lips, the cheeks, the tongue, and on the soft palate. The punctiform angiomas were not seen on the mucous membrane of the nose.

In the three cases here described, two belonged to a family in which epistaxis had occurred in seven members. Both of my patients had had bleeding at the nose from childhood, and both presented numerous punctiform angiomas on the skin of the face and of the mucous membrane of the nose, lips, cheeks and tongue.

The third patient had suffered in an unusual degree from recurring epistaxis, and the telangiectases were most abundant over the body, and very numerous also on the mucous membranes.

The condition has nothing to do with haemophilia, with which the cases had been confounded.

*Case I.—Attacks of Epistaxis from boyhood; seven members of the family subject to it. Telangiectases on skin of face and on mucous membranes of nose and mouth.*

George B., aged 57, a seaman by occupation, admitted to the Johns Hopkins Hospital May 31, 1897, with anaemia and swelling of the feet.

*Family History.*—The father died at 69, of stone in the bladder. From boyhood at intervals he had had bleeding from the nose, never, so far as his son knows, from any other situation, nor does his son think that he bled specially from cuts. The bleeding was very frequent, generally, the son says, every day. So far as he remembers he never was in any danger from it.

The mother, who is living and well, aged 81, has never had epistaxis. He does not know of any members of his father's or mother's families who were bleeders.

*Brothers.*—Two died suddenly, one aged 47, the other aged 57. Neither had ever bled from the nose. He does not know the

cause of death. The history of a third brother, who has had epistaxis from boyhood, will be given subsequently.

*Sisters.*—One died at 59, of Bright's disease. She was a large, stout woman, and had been subject to epistaxis from childhood. A second sister, the mother of fourteen children, died several years ago in childbirth. He does not know whether it was from haemorrhage. She had bled from childhood both from the mouth and nose. He does not know whether she had any "spots" on her nose or lips.

In the third generation, this patient has one child, aged 13, who has bled occasionally from the nose. He has never heard that any of his nephews or nieces have bled, but a grandniece, granddaughter of the patient's elder sister, has had epistaxis frequently.

*Personal history.*—He had been a sailor for forty-three years. He had been a moderate drinker. He had had syphilis thirty years ago. With reference to the epistaxis, he does not remember to have had it before his tenth year. The attacks were not very severe, but recurred almost every day. He was able to go to school, and later to his work. Twenty years ago, when he was thirty-seven, the condition became much more serious, and for nearly three years he was unable to do any work on account of the weakness and anaemia induced by the bleeding. He seems to have had a great deal of prostration, and says that for nearly five months he could not use his left arm. He has never bled from cuts, and never from the gums. While in the Navy, in 1862, he bled from one of the angiomas on the lower lip, also from a very small one on the skin of the septum. He has frequently been very anaemic, and has had swelling of the feet and shortness of breath. He has had haemorrhoids for thirty years, and fourteen months ago had them removed at the Marine Hospital. He has bled indifferently from right or left nostril. Latterly the bleeding has become much more aggravated, and he has become very anaemic.

*Present condition.*—The patient was a large framed, well nourished man, very intelligent. He was short of breath, the

face looked a little swollen, suffused and anaemic; the feet and legs were swollen. The blood examination gave 2,980,000 red blood corpuscles, leucocytes 8000, haemoglobin between 15 and 20 per cent. The nostrils were very capacious, and there was a clot of blood projecting from the left orifice. He had bled up to time of admission. The coagulation time as taken by Wright's tubes ranged from five and a half to seven minutes.

The general surface of the skin was pale, a little yellow. No haemorrhages were seen except on the right elbow where was a rounded area of subcutaneous extravasation about  $1\frac{1}{2}$  cm. in diameter. The face presented a very unusual appearance, owing to the large number of dilated venules and capillary and venous telangiectases. They were most abundant on the ears, the skin of which presented a remarkable appearance, partly from the dilatation of the venules, which could readily be seen, and partly from the bright red capillary telangiectases. There were some dilated venules on the nose and cheeks, and the lips present a number of angiomas, particularly on the mucous surface, and just at the junction of it with the skin. There were one or two small ones about the skin of the nostrils, and subsequent examination showed numerous angiomas on the mucosa of the septum, particularly on the cartilaginous portion.

The mucous membrane of the mouth looked normal, but the tongue, on the tip and along the edge for a little distance, showed a number of telangiectases.

There was no albumin in the urine; the specific gravity was 1010, no casts. His legs were swollen to the middle of the calves. There were dilated venules on the outer aspect (p. 335) of the legs. The edge of the spleen could just be felt. The liver was not enlarged. The apex beat of the heart was felt just under the right nipple. There was a soft systolic murmur at the apex, and a louder one along the left sternal border. The bleeding stopped shortly after admission.

On May 25, he had a slight attack of epistaxis, which lasted for thirty minutes. The general condition had much improved. The oedema had disappeared from the extremities, and he had gained rapidly. The blood condition improved, and on the 25th the red corpuscles were 3,224,000.

This patient has reported at intervals at the Dispensary through 1898, 1899 and 1900. He has had bleeding from the nose at intervals, lasting for a few hours at a time. When last seen he looked very well, though a little anaemic. There has been no special change in the cutaneous telangiectases.

Case II.—*Epistaxis from childhood; Telangiectases of skin and mucous membranes, bleeding from some of the spots. Cancer of the stomach, death, autopsy.*

William B., aged 55, admitted Jan. 20, 1899, complaining of stomach trouble.

*Family History* given with Case I.

*Personal History.*—He began to bleed from the nose very early in life; he does not remember exactly the date. It has been a source of constant trouble, and has on several occasions caused extreme anaemia and weakness. He usually bleeds without any provocation. He has never bled freely from cuts, but on several occasions spots on the face have bled after shaving, and he has bled from the red spots on the lips. Of late years he has bled less frequently than when he was a younger man. He has been a sailor, and has led a very irregular life; has used tobacco freely, and has been at times a very heavy drinker.

He came into the hospital complaining of nausea, vomiting and pain in the abdomen, which he had had for some months.

*Present Condition.*—The patient looked pale and sallow, and there were numerous small varicose veins on the skin and mucous membrane of the lips, and on the side of the nose, a few on the cheeks and on the ears. On the tongue there were a number of small red spots, evidently of the same nature. The same spider-like angiomas could be seen on the mucous membrane of the septum of the nose. They were not so numerous nor so striking a feature as in his brother's case, though those upon the mucous membrane of the lips were large enough to at once attract attention. The patient had a large tumor mass, in the abdomen, evidently a new growth of the stomach.

Blood examination the day after admission: r. b. c. 4,488,000; leucocytes 7400; haemoglobin 71 per cent. The blood coagulation time on Jan. 20th was eleven minutes; on the 22d, it was

eleven minutes; on the 25th it was eleven minutes; on the 26th it was nine and a half minutes. He had repeated bleedings, and then on January 31st the coagulation time was four minutes, after he had been taking calcium chloride, fifteen grains three times a day for three days.

He bled freely from the nose two days after entering the hospital, and was given 250 cc. of a one per cent gelatin solution hypodermically. The blood coagulation time was reduced to one and a half minutes.

On January 30th he had two bleedings from the nose, and again on the 31st. On Feb. 6th he vomited coffee-ground material. On Feb. 9th he had another bleeding from the nose. On Feb. 10th the blood coagulation time was one minute. On Feb. 18th he had a right hemiplegia. He grew progressively weaker, and died on Feb. 24th.

The anatomical diagnosis was: cancer of the stomach, mesentery, omentum, liver, retroperitoneal glands, lungs and brain. Angiomata in mucous membrane of the nose and of the stomach. In the stomach there were a dozen round foci, each 3 to 4 mm. in size, which at first looked like ecchymoses but were dilated venules and capillaries.

Section of the septum of the nose made for me by Dr. Austin, showed many large dilated veins just beneath the epithelium.

Case III.—*Recurring Epistaxis from the 10th year—Multiple Telangiectases of skin and mucous membranes of nose and mouth.*

M. W. C., Inez, Martin Co., Ky., aged 49, was admitted to the Johns Hopkins Hospital, August 28, 1896, complaining of epistaxis, which had recurred at short intervals from his boyhood.

His mother died of consumption; she had had inflammatory rheumatism. His father died of Bright's disease. He has three brothers and one sister living; one sister died of consumption. So far as he knows there are no "bleeders" in his family, and none of the members has had serious attacks of epistaxis.

With the exception of epistaxis, the patient has been a healthy man. He had typhoid fever when twenty years of age. He has never had rheumatism. He had gonorrhoea at eighteen. He has

never had syphilis. He has used alcohol in moderation. He was a very active boy and took a great deal of exercise. When ten years old he began to have epistaxis, which often followed the trick of walking upon his hands. He would bleed quite profusely for part of a day, or for some hours every day or two for ten days or more, until he got quite weak and anaemic. The attacks were sometimes of much greater severity than at others. For some years he did not pass a week without bleeding from the nose. It usually began as an oozing, and then would end in a very free haemorrhage, lasting from a few minutes to half an hour. Between his eighteenth and twenty-five years he was very much better, and it was thought that perhaps the tendency had been checked. It did not stop entirely, but he was very much better. Then it recurred, and during all these years he does not think he has passed a week without some bleeding from the nostrils, from either one indifferently.

(p. 336) He has been an active business man, and the bleeding has interfered very much with his work, as he would get pale and very weak. He has often had to have the nostrils plugged, and at times after severe bleeding he would get very pale, and as he said, "the blood would be so watery that my feet would swell." He never has had any haemorrhages into the skin, but he has had at intervals bleeding from the 'spots' on the gums and lips, he thinks perhaps as often as twenty-five times. When a lad (he cannot fix the exact date), he noticed reddish spots on his face and about his hands; they have persisted and have increased in number during the past seven or eight years. He has never had any other haemorrhages than those mentioned.

*Present condition.*—The patient was a very well nourished, robust looking man, pale (as he had recently had a very severe haemorrhage), with all the outward evidences of anaemia. The blood count was: red corpuscles, 3,460,000; haemoglobin 38 per cent. There was marked poikilocytosis; the leucocytes were normal in number. The differential count gave lymphocytes 10 per cent, large transitional forms 9 per cent, polynuclear 80 per cent, eosinophiles 1 per cent. The lymphatic glands were not enlarged. There were haemic murmurs at the base of the heart,



and a soft systolic at the apex. Neither spleen nor liver was enlarged. The coagulation time, as taken by Wright's tubes, was two minutes and a half.

*The telangiectases.*—These were most numerous on the face, which was much disfigured by them. On the right cheek there were twenty-five, some of which projected slightly beyond the skin as purplish spots from 1 to 4 mm. in diameter; the largest presented a stellate arrangement of veins. On the left cheek there were about twenty, several with quite large veins passing to the centre. While most of them were quite superficial, there were others subcutaneous and bluish in tint. On the lower lip the edge at the skin was closely set with them, and on the mucous membrane of the left side there was an angioma the size of a split pea. On the upper lip there were many small ones, and in the very centre, just at the raphé, there was a large, deeply seated, blue one. Scattered over the forehead were eight or ten, most of them purplish red, one or two near the margin of the scalp deep seated and blue. Here and there on the scalp a few could be seen. On the upper surface of the tongue there were five or six, and several on the under surface, all of them small and very bright red in color. There were none on the pharynx, but there were a number on the inner surfaces of the cheeks and on the gums, which were not swollen. The skin of the ears presented numerous pin point telangiectases, giving to it a very peculiar appearance; the spots were about the size of the central point of a flea bite.

Scattered over the back, chest and abdomen were two or three dozen bright red angiomas, none of them more than 2 or 3 mm. in diameter. Several of them project, and one or two are almost pedunculated. The arms and legs are practically free. On the hands, however, there are a good many angiomas, nearly all small and pin point. They are scattered over the fingers and palms, particularly about the pads of the fingers.

Dr. Warfield made several careful examinations of the nose, and reported that on both sides of the septum there were numerous scattered angiomas, very similar in appearance to the smaller

ones on the cheeks, and tortuous veins could be seen radiating from their centres. With the exception of these spots the mucous membrane of the nose and throat looked normal.

The patient remained in hospital until September 18th. In the first ten days there were six bleedings from the nose. On September 9th Dr. Warfield thoroughly cauterized the angiomata on the septum. The operation was followed by quite profuse haemorrhage, which was readily stopped. On the 10th the haemorrhage recurred and he lost 580 cc. of blood before it was checked by plugging. Half an hour later he had a second haemorrhage in which 820 cc. were lost. Within twenty-four hours he bled 1400 cc. He was not very much prostrated, but looked a little pale. This was the largest bleeding he had had while in the hospital, but he said he had not infrequently had much more profuse haemorrhage. Between the 10th and the 18th, the day of his discharge, he had no bleeding.

*Subsequent history.*—Patient heard from June 5th, 1897. He stated that he had been better than for any time for the past ten years, but he still has occasional bleeding for a day or two pretty freely. He thinks that the cauterization has saved his life. He has been so much better since it was done. After bleeding for a few days, he takes the iron and arsenic.

Oct. 11, 1897, I had a note from this patient to the effect that he had had very severe bleedings during the past three weeks.

Jan. 5, 1898. He has been bleeding very badly for the past five weeks, and is in a very weak, critical condition.

Dec. 16, 1898, he writes, "I am still troubled with the haemorrhages, but am able to attend business. I have procured in the last three months a gum arrangement, which I insert and inflate with air, and keep it in for fifteen or twenty-five minutes, and it stops the bleeding entirely. It is a great improvement on the old plan of plugging with cotton or anything else. I can use it at once myself, and it causes no pain. Since I have had it I am holding my blood, and I think now I will get stronger."

He sent a diagram of a very ingenious arrangement. He took a rubber finger-stall about three inches long, into which was tied

a small bit of rubber-tubing, with a stop-cock at one end. He inserted the finger-stall, relaxed, then put the tubing in his mouth, inflated it, and turned the stop-cock.

Nov. 16, 1899. Patient heard from to-day. He says that with the instrument above described he has succeeded in "holding his blood." Still bleeds a little, but not so frequently as he used to do. He has been able to attend to business.

(p. 337) REMARKS

Angiomata are very peculiar and remarkable structures, in which I have been interested for many years. Apart from the big nevi and angiomata with surgical relations there are:

1. The pin-point, punctiform, capillary angioma, of which few skins lack examples. They may be numerous, but they are rarely disfiguring. They appear and disappear. For ten years I had one the size of a pin's head on a finger.

2. The solid, nodular nevus, ranging from 1 to 4 or 5 mm. in diameter, forming a definite little tumor, either sessile or pedunculated, and very common on the back.

3. The spider angioma, formed by (a) three or four dilated veins, which converge to and join a central vessel; or (b) which unite at a central bright red nodule projecting a little beyond the skin. They are very common, and doctors are often consulted about their presence on the face.

As examples may be found on the skin of nearly everybody, these three varieties may be regarded as almost normal structures.

When the punctiform or spider angiomata increase greatly in numbers they are very disfiguring. In Case III the skin of the face was peppered with them, and at a distance the patient looked disfigured with a bright, fresh acne rash. In Case I they had also proved a source of danger, as he had bled from them repeatedly. An individual spider angioma may increase in size, or, as in the cases I have here related, they may become very numerous.

Angiomata have a curious relationship with affections of the liver. In cirrhosis, in cancer, in chronic jaundice from gallstones spider angiomata may appear on the face and other parts. They

may be of the ordinary stellate variety, like the stars of Verheyen on the surface of the kidney, or the entire area of the star may become diffusely vascularized, so that there is a circular or ovoid territory of skin looking pink or purple, owing to the small dilated venules. A dozen or more of these may appear on the trunk, or even large ones may disappear. And lastly, in a few cases of disease of the liver I have seen large, mat-like telangiectases or angioma involving an inch or two of skin, and looking like a very light birth-mark, but which had appeared during the illness. The skin was not uniformly occupied with the blood vessels, but they were abundant enough on the deeper layers apparently to give a deep change in color and to form very striking objects. The dilated venules on the nose, and the chaplet of dilated veins along the attachment of the diaphragm are not infrequently accompaniments of the spider angiomas in cases of disease of the liver.

I have recently seen the spider angiomas appear in the face in a case of catarrhal jaundice.

THE END



# Chronic Cyanosis, with Polycythemia and Enlarged Spleen: A New Clinical Entity

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**T**HE group of cases here reported, with those collected from the literature, are worthy of careful study, as we have here in all probability "A definite clinical entity and one which is new to medical science," to use the words of Saundby and Russell in describing their case. The condition is characterized by chronic cyanosis, polycythaemia and moderate enlargement of the spleen. The chief symptoms have been weakness, prostration, constipation, headache, and vertigo. A further analysis will be reserved until after the consideration of the cases:

Case I. *Cyanosis for years, of unknown origin; albuminuria; rapid pulse; polycythaemia; high vascular tension.*—Dr. K., aged forty-four years, consulted me October 28, 1901, complaining of a rapid pulse and diffuse cyanosis. He has been a very healthy man, active and vigorous, of good habits; has had no serious illnesses. He has been uneasy about himself, as he had detected a trace of albumin in the urine. For several years his wife has

noticed that he has had a very congested appearance, and the eyes would often be deeply suffused. I have seen him at intervals for the past five years and have known him to be a very blue-faced man. He has been of a constipated habit. His eyes are somewhat prominent, but his wife says this is natural to him. He has constantly a feeling of fulness in the head, sometimes a sensation of vertigo, and for these symptoms he consulted me.

He was a well-built, well-nourished man; the face much suffused; the ears looked a little blue; the conjunctivae were injected, and the lips distinctly cyanotic. The tongue also looked cyanotic. The general surface of the skin looked suffused and the anaemia left after pressure of the hand on the skin was very marked and very slowly (p. 188) obliterated. The feet and hands were quite cyanosed. The radials and temporals were moderately sclerotic. Pulse 120, regular. Apex beat in fifth, just inside the nipple line; sounds clear; aortic second a little accentuated. There was no enlargement of the thyroid. No enlargement of the liver; moderate enlargement of the spleen, the edge of which was palpable. The chest was well formed, not barrel-shaped; the cervical muscles not prominent. Expansion of the chest good. No sign of emphysema. Expiration not prolonged. Once or twice he called on cold days to show the extreme cyanosis, and twice he came in with cough, which troubled him chiefly at night.

Several careful analyses of the urine were made by Dr. Futcher. The specific gravity ranged from 1012 to 1017; albumin was constantly present, as a rule only a trace; no sugar. On centrifugalizing there were a few hyaline and finely granular casts.

I was very much puzzled as to the nature of this case, and thought that he had some chronic degeneration of the kidneys, with slight arterio-sclerosis, but I did not think it could be advanced, as there was no marked hypertrophy of the heart, and the aortic second was not specially ringing. I could not account for the cyanosis.

*Blood.* The examinations were made by Dr. Futcher. Drop from ear almost black in color; flows sluggishly. A striking feature is the slowness with which the drop spreads under the

cover. With the usual-sized drop the field is found almost filled with red cells; they look natural. Another striking feature is the relative scarcity of leucocytes. Red blood corpuscles, 9,952,000; leucocytes, 4000; haemoglobin, 120 per cent. (Fleischl). No measurements of the red cells were made. Several counts were made, as it was thought that there might have been a mistake.

Two observations of the blood pressure, taken on the right arm when he had been in the sitting posture for about ten minutes, gave maximum pressure, 203 mm. Hg.; minimum pressure, 175 mm. Hg. Five minutes later the maximum pressure, 200 mm. Hg.; minimum pressure, 172 mm. Hg.

I saw this patient repeatedly during 1902. There was very little change in the condition. The cyanosis was always marked. He was able to attend to his practice. There was no shortness of breath; the heart's action became slower. I once counted it at 72, but he said that it was often at 120 per minute. The last examination of the urine, November 14th, showed only a trace of albumin and a few hyaline casts. The spleen never became much enlarged, but it was always easily palpable. He went to California and has since been under the observation of Dr. McBride.

Case II. *Recurring attacks of nausea and vomiting; remarkable cyanosis, of some years' duration; pain in side; polycythaemia; albuminuria.*—M. C. (General Hospital Nos. 31202, 34970, 38753, 40820, 42041), aged thirty-five years, a Russian Jew; tailor by occupation; admitted for the first time on July 11, 1900, complaining of constipation.

The family history was unimportant.

*Personal History.* The patient has always been well. Since coming to this country, six years ago, he has been pressing in a tailor-shop, and has had to work standing. He denies gonorrhoea and syphilis. He uses alcohol moderately. Ever since coming to the United States the patient has been troubled with constipation, the bowels never moving (p. 189) more frequently than every second day. This is worse in the summer. Three years ago, during the summer, the bowels on one occasion were consti-

pated for fourteen days. There is no pain during these attacks. For a long time he has been dark in color; he does not know for how long, but his friends have noticed it.

The patient's bowels moved eight days before admission after taking licorice powder. He had been constipated for four days previous to that. Seven days ago the patient began to vomit after each meal. He has vomited daily since. Castor oil, Epsom salts, and licorice powder have been ineffectual. There have been no other symptoms save that of drowsiness. The patient has voided very little urine during these eight days.

On examination the patient was a well-nourished man, with marked cyanosis of the face, hands, and mucous membrane; the tongue was heavily coated.

The physical examination proved entirely negative, except for the cyanosis already noted. The temperature reached  $102^{\circ}$  shortly after admission, and fell to normal by midnight and remained so. On this day the blood count was: red blood corpuscles, 7,172,000; leucocytes, 21,800; haemoglobin, 120 per cent.; no malarial parasites found; Widal reaction negative.

On July 16th the blood count was: red blood corpuscles, 6,520,000; leucocytes, 14,400; haemoglobin, 102 per cent. The patient is feeling very much better and the bowels are moving regularly.

The patient was admitted for the second time on May 27, 1901, complaining of vomiting, which came on five days before admission. The patient admitted excessive indulgence in soda-water on the day of the illness. He states that he has vomited "every moment" since the onset, and that there has been some blood in the vomitus, which is very foul-smelling. The bowels have been constipated since the onset. He has eaten nothing for several days. There is no abdominal pain.

*May 29th.* Dr. Fitcher noted that the cyanosis was still very marked, especially in the buccal mucosa, and that there was a marked pyorrhoea alveolaris. Slight tenderness in the right iliac fossa. The spleen and liver were not enlarged.

*27th.* The blood count gave red blood corpuscles, 8,900,000; leucocytes, 23,000; haemoglobin, 125 per cent.

*28th.* Vomiting continues unabated. Calomel, cerium oxa-



late, and lavage have been ineffectual in stopping it. Analysis of the vomitus: total acidity, 85; free HCl, 37; no lactic acid.

*29th.* Red blood corpuscles, 10,200,000; haemoglobin, 112 per cent.

*30th.* Lips very livid; the general surface of the skin, including face, trunk, and extremities suffused. The imprint of the hand disappears very slowly, and the nails are a little cyanosed.

*June 1st.* Patient's bowels were finally moved by a high enema. The blood count was as follows: Red blood corpuscles, 7,576,000; leucocytes, 30,000; haemoglobin, 115 per cent.; specific gravity (chloroform and benzol method), 1068.

*4th.* The patient was discharged feeling greatly improved, the bowels having commenced to move somewhat more freely.

The patient was admitted for the third time on April 29, 1902, complaining of an attack of vomiting, hiccoughing, and constipation, which began seven weeks previously. He had vomited bile several times (p. 190). The attacks of vomiting have lasted for ten or twelve days at a time and recurred repeatedly. The blood count on admission was as follows: Red blood corpuscles, 7,144,000; leucocytes, 8,600; haemoglobin, 110 per cent.

On April 30th Dr. McCrea noted that the area of stomach tympany was slightly increased; cyanosis still present; considerable pigmentation of the skin. Differential count of the leucocytes: Polymorphonuclear, 79.4 per cent.; small mononuclear, 14 per cent.; large mononuclear, 2.4 per cent.; eosinophiles, 1.8 per cent.; transitionals, 2 per cent. A test-meal showed free HCl present; no lactic acid. On two successive days after a long fast the stomach-contents were removed and revealed a fair amount of free HCl. The blood count on May 12th was little changed.

On May 22d the patient was discharged improved, the bowels moving regularly.

The urine had a specific gravity of 1010 to 1020, with a trace of albumin and a few casts, usually hyaline, but on one admission granular.

The fourth admission was on November 7, 1902, the patient stating that he was awakened at 4 A.M., three days before admission, with a pain in the left side, followed by vomiting, which

has been continuous since. No blood in the vomitus. Constipation for five days. The patient has not eaten anything since the onset and has taken very little water. There has been some hiccoughing. Blood count: Red blood corpuscles, 7,316,000; leucocytes, 12,300; haemoglobin, 112 per cent. The cyanosis is still very marked. There is some dyspnoea, vomiting, and hiccoughing. A differential count of the leucocytes shows a slight increase in the polymorphonuclears and a diminution in the small mononuclears since the previous record. The specific gravity of the blood is 1083.

*November 12th.* Red blood corpuscles, 8,300,000.

*15th.* Red blood corpuscles, 6,700,000. Coagulation time, one and a half minutes. Specific gravity, 1072.

*19th.* The vomiting persisted until two days ago and the vomitus showed at all times free HCl; no lactic acid; slight starch digestion. The constipation was also very obstinate until yesterday. Discharged improved.

Patient admitted for the fifth time on January 28, 1903, and for the sixth time March 11th. On both of these occasions the chief symptoms were pain in the left side and the obstinate constipation. He says that the pain brings on the vomiting. The vomitus is at first frothy and white, later greenish in color. The pain is deep below the tenth and eleventh ribs on the left side, and extends toward the posterior axillary fold. On his last admission the cyanosis was extreme, the face was almost black, and the expression very anxious. There was no albumin in the urine, but on March 30th there were a few granular casts. The blood pressure was 125; the specific gravity of the blood 1081. The bowels were freely moved, and this always gives him relief. On the last admission there was very little vomiting, yet the cyanosis was never more marked.

*May 25th.* Patient has been keeping very well and is at work. He complains of pain in the left side, under the ribs, and says that as he walks he keeps his hand over the sore spot. The cyanosis is marked, (p. 191) quite as much as at any time in the hospital. The impression of the hand on the skin of the trunk remains a long time. The spleen is not palpable; the vertical flatness is

about four inches in extent. He thinks that the skin has become darker.

Case III. (Dr. Lowman.) *Chronic cyanosis; enlarged spleen, polycythaemia; headache; increased tension; albuminuria.*—While making a visit at the Lakeside Hospital, Cleveland, with Dr. Lowman, my attention was directed to a patient who was unusually cyanosed and who had an enlarged spleen. On further examination the case was found to belong to the group under consideration. I am indebted to Dr. Darby, Dr. Lowman's first assistant, for the notes of the case.

Female, aged forty-four years, married, of English descent, admitted to the ophthalmological division of the hospital for double pterygium, failing vision, and headache; for the latter she was transferred to the medical service. The condition of the fundi was negative, with the exception of tortuosity of the vessels.

The family history was negative.

She had had the usual infectious diseases. She had been a very healthy woman of good habits. There was no history of syphilis. She had not had winter cough or attacks of asthma. She has two children living and well. For many years, she does not know how long, she has been blue. She has had no cough, no special shortness of breath on exertion. For four years she has had headaches, which have become more intense during the past four months. They begin over the left eye and extend backward and down the neck.

On examination the patient is well nourished; the skin is dark in color, and there is a general cyanosis, particularly marked on the face, arms, and upper part of the trunk; the feet and toes are blue. Everywhere the impression made with the finger disappears slowly. The conjunctivae are suffused. The eyes are not specially prominent. There is well-marked pterygium. Looking more closely at the face there are some distended venules about the nose and cheeks. The lips are quite cyanosed, and the tongue and buccal mucous membranes have a dusky blue color. The radials are moderately sclerotic; the vessels seem full and the tension high. The apex beat of the heart cannot be felt; there is no visible shock; no enlargement upward or to the right.

The sounds are clear; the second pulmonic is accentuated. The chest is not barrel-shaped. Percussion note is clear everywhere, and there are no bronchitic râles; no prolongation of expiration.

The abdomen looks normal. On palpation the spleen is enlarged, extending 7.5 cm. below the costal margin; the anterior margin and the notch are easily felt. The upper limit of flatness is on the eighth rib. The liver is not enlarged.

*Blood.* April 13, 1903, red blood corpuscles, 11,616,000; leucocytes, 5100. Differential count: Polynuclears, 59 per cent.; lymphocytes, 32 per cent.; large mononuclears, 8 per cent.; eosinophiles, 0.5 per cent. Haemoglobin, 120 per cent. Specific gravity, 1067. A subsequent examination made on May 8th gave the red blood corpuscles 10,692,000.

*Urine.* No excess of the daily amount; clear in color; specific gravity ranged from 1010 to 1016; reaction acid; a trace of albumin and a moderate number of hyaline and granular casts.

At my suggestion the patient was put upon sodium nitrate, and (p. 192) Dr. Darby writes, under date of May 8th, that the headaches have entirely disappeared.

Case IV. (Dr. Stockton.) *Chronic cyanosis; general weakness; headache, and general pains, with attacks of weakness and shortness of breath; pigmentation of skin; death; autopsy.*—When speaking of the condition with Dr. Lyon, of Buffalo, he mentioned a remarkable case of chronic cyanosis in the Buffalo Hospital under the care of Dr. Stockton, and on his return he found that there was polycythaemia. To the former I am indebted for the following notes, and to the latter for permission to use them:

J. T., a Turkish Jew, aged forty-six years, married, a shoemaker, had been admitted to various Buffalo hospitals (General, Erie County, German, etc.) for several years on different occasions, and died in the German Hospital, Friday, May 1, 1903.

His chief complaint was general weakness, chronic headache; pain in the feet and legs, made worse by walking; general diffuse pains in the abdomen, pains also over the region of the heart, moderate chronic constipation, a slight cough, and occasional attacks of shortness of breath.

For about twenty years he has had a slight cough, off and on,

worse in the winter and at night. Headache has troubled him for the same period (twenty years), and indefinite pain in the chest has been felt more or less during the past twenty years. His general strength had been of exceptional vigor until about six years ago, when it began to fail. About four years ago he began to grow much darker and bluer in his skin—cyanosed. Then he began also to have pains in different parts of his body, pain and a prickling sensation in the legs and feet, pain in the right chest and right shoulder; pain in the abdomen, not localized, but diffuse and general; headache continuing. The pain in different parts of the body was not constant, but shifted from time to time. However, the headache and the pain in the legs and abdomen were present with tolerable constancy and have continued so up to his death. The pain was described as dull and aching. In addition to the pains, he had marked weakness during the last six years of life.

Constipation was never a marked feature of the case, though the bowels were generally sluggish. The appetite was poor and capricious. He had nausea occasionally, but never vomited.

During the past four years he had been going from hospital to hospital, spending a few months at a time in each, until he felt better, then returning to his home and trying to work, but soon being required to return to a hospital because of his weakness, headache, body pains, and sometimes shortness of breath. In the hospital he would remain in bed most of the time, or sit quietly in a chair, occasionally walking slowly around the ward or going to the dining-room for his meals.

*Cyanosis.* The most striking feature of the case during the past four years has been a high-grade, extreme, general cyanosis, making the patient an object of general interest and curiosity in the various hospitals where he sojourned. His entire skin was dusky and bluish and his mucous membranes livid, resembling the appearance of a "blue baby" with congenital heart disease; in fact, he was jocularly called the "blue baby." This cyanosis was constant, though at times after rest in bed it improved somewhat, and again at other times was much intensified.

(p. 193) *Pigmentation.* The skin was generally dark and

showed fine punctiform mottling or pigmentation, suggesting capillary extravasation as a cause, though no definite history of subcutaneous hemorrhages could be obtained. The naturally pigmented parts of the body were much more deeply pigmented than normal. The mucous membranes showed no appreciable areas of pigmentation.

*Dyspnoea.* During the last three years of life he had occasional attacks of increased weakness, cyanosis, and dyspnoea, his body becoming cold, so that his wife had often thought him dying. In the hospital, however, dyspnoea was seldom marked, though the respirations were generally moderately increased.

*Physical Examination.* A short, stocky, well-built, and well-muscled man. Cyanosis as already noted. Pigmentation as already noted.

*Heart.* The heart sounds were always clear and without murmur at any time, but were generally rather weak, except the second pulmonic sound, which was somewhat accentuated. The heart's area by deep percussion was slightly enlarged to the left and right. In the sixth interspace, about one and a half inches to the left of the nipple line, could be seen an area of pulsation, the chest wall dimpling inward with each systole—*i.e.*, systolic retraction. This sign required a careful inspection to be seen.

*Vessels.* The arteries were soft and compressible. The veins were everywhere full and visible. There was slight throbbing of the vessels of the neck, above the clavicles, thought to be arterial.

*Thorax.* The lungs were everywhere hyperresonant on percussion, and the area of resonance extended downward at the bases behind somewhat, and in front on the right side the area of liver dulness did not begin until the seventh space was reached in the parasternal line. The area of resonance above the clavicles was not appreciably increased. On auscultation the breath sounds were soft and expiration was not prolonged. Occasional wheezes and sibilant râles could be heard over both lungs on different occasions during the last few months of life. (Dr. Thayer, who saw this case with Dr. Lyon, tells me that the state of the chest did not suggest to him emphysema.)

*Liver.* Flatness began in seventh space in parasternal line

and extended vertically downward to about two inches below costal margin, where the edge could be felt.

*Spleen.* Never palpable, and its area on percussion was less than normal (perhaps explained by the emphysema of the lungs).

*Abdomen* normal.

*Glands* normal.

*Legs.* Occasionally very trifling oedema was observed over the ankles, more distinct on the left side. No oedema elsewhere was ever observed.

*Eye Examination,* February, 1903. Both disks hyperaemic. Retina surrounding disks thickened. Vessels, particularly veins, engorged and tortuous.

*Urine.* An occasional trace of albumin; otherwise negative.

*X-ray Examination of Thorax.* Nothing abnormal except slightly enlarged heart.

*Blood.* The blood from the ear or finger-tip was on many occasions during the last few months of life examined and found extremely dark in color, and so thick that it would adhere to one side of thin filter (p. 194) paper without penetrating it. The depth of color and darkness of the blood was far beyond the range of estimation for haemoglobin by the color scales of the various haemoglobinometers. The red corpuscles were never counted until the day of death, when they were counted at 8,250,000. Differential leucocyte count normal. Leucocytes were generally about 8300, never showing a hyperleucocytosis.

*Pulse.* The pulse was generally about normal, occasionally after exertion rising temporarily as high as 120 to the minute.

*Temperature* always normal.

*Respirations.* The general respiratory rate was from 22 to 25 per minute, once reaching 50 after severe exertion, with symptoms of collapse. On the afternoon of death the respirations were 38 per minute.

Death occurred on May 1, 1903, at 7 P.M., at the German Hospital in Buffalo, after three days' residence in the hospital. The patient died, without any special symptoms or discoverable complications, in collapse and after a few hours of drowsiness deepening into semiconsciousness.

The full report of the autopsy is not yet available, but Dr. Lyon writes that the heart was about normal; the lungs showed moderate emphysema, with cyanosis and oedema; the spleen was moderately enlarged. Nothing definite was found to account for the condition.

#### CASES FROM THE LITERATURE

Case V. (Vaquez, *Bulletin Médical*, Paris, 1892, vi., 849.)—Male, aged forty years. For ten years extremities cyanosed; veins distended. Then palpitations, dyspepsia, bronchial catarrh. Three years ago vertigo (Ménière type); buzzing and whistling in ears; staggering and eddying of objects; vomiting; no unconsciousness. Gums swollen, bleeding on irritation.

On examination, chronic cyanosis; no oedema. Heart: No definite auscultatory phenomenon. Blood: Red blood corpuscles, 8,900,000; leucocytes, normal.

Second admission: Paroxysmal vertigo. Attack of pain in lumbar region, ended by discharge of red blood corpuscles in urine, lasting four to six days. Liver enlarged, 20 cm. in right mammary line. Spleen 24 cm. in extent. Urine, three litres daily; same amount of fluid as ingested. Blood: Finger, 8,450,000; elbow, 8,200,000, once 9,130,000; specific gravity, 1080; haemoglobin, 165 per cent.; hyperalkalinity of blood.

*Pathology.* Probable hyperactivity of haematopoietic organs, for of two cases of congenital cyanosis, one, with red blood corpuscles, 7,000,000, had a large spleen; the other, with 4,500,000, had no palpable spleen.

Case VI. (Cabot, *Boston Medical and Surgical Journal*, December 7, 1899.)—Female, aged forty-six years, widow, masseuse. Six years before admission she had sudden loss of consciousness, with settling of blood on one side of face and thick speech, which lasted several days. Four years later, after a period of hard work, she began to have periods of collapse, mental and muscular; face became purple, eyes injected; she was once thought to be drunk; vasomotor phenomena often present. Sciatica two weeks before admission; ecchymoses on thigh.



(p. 195) On examination, cyanosis of the face and tongue. Heart: No murmurs. Urine: Trace of albumin; a few hyaline casts. Blood: Red blood corpuscles, 10,460,000; leucocytes, 20,000; haemoglobin, 150 per cent. Heart apparently normal; pulse 90. No note on the spleen.

*Course.* Rested well in summer, but still cyanotic. Thyroid treatment had no effect. Later on, after tooth extraction, bleeding lasted half a day; made her better. Soon afterward she had attacks in which her legs began to move spontaneously, the feet moving around each other. A second attack on the train in two weeks. Soon weakness of left arm and leg, headache, vomiting. She died comatose.

*Autopsy.* Hemorrhage, middle meningeal; passive congestion of all the viscera.

Case VII. (Cabot, *Boston Medical and Surgical Journal*, March 15, 1900.)—Female, aged forty-nine years, spinster. Complaint, vertigo, weakness, bad taste, constipation. Blue line noted. Given potassium iodide and cascara.

One year later, trace of albumin and hyaline casts in the urine. Lead detected in the blood. Blood: Haemoglobin, 120 per cent.

Father died of "consumption of blood."

Otitis media at eighteen years; several attacks of rheumatism. Menopause at forty-six years. Since then vertigo, palpitation, and headache; dizzy most of time. No tinnitus or nausea or eye symptoms. Cyanosis of lips for six months. Constipation. Four months ago three teeth drawn; then stomatitis set in. Itching at night. Polyuria.

On examination, cyanosis of face and mouth, hands and feet. Heart: Slight systolic murmur at pulmonary area. Spleen enlarged up and down. Haemoglobin, 120 per cent. In one week vertigo and cyanosis diminished. Haemoglobin, however, remained at 120 per cent. Four years later, red blood corpuscles, 12,000,000; spongy, bleeding gums; vertigo and staggering; skin bronzed. Lost twenty pounds in six years. Spleen a hand's breadth below ribs. Red blood corpuscles, 9,252,000; leucocytes, 10,600; haemoglobin, 110 per cent. After venesection, red blood

corpuscles, 10,032,000; normoblasts, 5. Later spleen reached to navel; red blood corpuscles, 11,352,000. Examination of gastric contents: No free HCl.

Case VIII. (McKeen, *Boston Medical and Surgical Journal*, 1901, cxliv., 610.)—Male, aged fifty-three years, German, packer in iron foundry.

Family history unimportant.

*Personal History.* Dyspnoea twenty years ago, eight days; recurred at intervals of six months to two years. Alcohol, beer, and whiskey used moderately.

*Present Illness.* One and a half years ago cyanosis of face and hands following an attack of dyspnoea. The cyanosis has persisted since, with exacerbations. Works right along; exertion causes no dyspnoea or cyanosis. Every second or third day blurring of vision, sweating, vertigo, staggering; no headache or tinnitus. When blue the hands are cold and numb. For two years frequent attacks of diarrhoea, sometimes with prolapsus recti.

On examination, no dyspnoea; respirations 18 to the minute. Cyanosis of face, hands, and feet. Fingers clubbed. Erythema on (p. 196) shoulders and chest. Eyes congested. Tongue cyanotic. Gums swollen and bleeding. Many of the teeth loose. Arteries slightly thick. Heart, no murmurs. Lungs hyperresonant. Spleen one inch below rib, descending to two and a half inches on deep inspiration. X-ray showed emphysema. Urine: A trace of albumin, granular casts, red blood corpuscles, and leucocytes. Blood: Red blood corpuscles, 9,380,000 to 9,840,000; leucocytes, 9000; haemoglobin, 120 per cent.

Case IX. (Saundby and Russell, *Lancet*, 1902, i., 515.)—Male, aged forty-three years, an electroplater. First visit on April 13, 1891, complaining of pains in body, especially abdomen; headache for three or four months. Spleen enlarged. Urine: Specific gravity, 1010; a trace of albumin; no casts.

Second visit on January 29, 1898, complaining of cyanosis.

*Family History.* Mother died of phthisis.

*Personal History.* Syphilis at nineteen years, gastric fever at twenty-four years, later jaundice.

*Present Illness.* Eight months ago pains, gnawing, in abdomen, worse in morning; no vomiting; constipation. For six weeks loss of flesh and weakness.

On examination, dull, speech thick, memory and attention poor. Cyanosis of face. Fingers clubbed. Teeth bad. Bronzing of legs. Spleen extends to middle line and navel; hard, slightly tender. Heart: No murmurs. Red blood corpuscles, 9,000,000; haemoglobin, 120 per cent. Once a few hyaline casts. He grew drowsy, jaundiced, and cyanotic. Later, red blood corpuscles, 7,360,000.

*Autopsy.* Hypertrophy of left ventricle. Spleen, 1440 grammes; consistency normal. Brain congested. Suprarenal small, dark, soft. Thymus not noted.

Weil (*La Semaine Médicale*, June 29, 1901) has a brief note on two cases of hyperglobulism, with cyanosis, lasting from birth, in two children, one aged two years, the other four years. The blood count is not given. In one the spleen was enlarged, in the other normal. No heart disease.

#### ANALYSIS OF THE CASES

Six of the patients were males and three females. All were in the middle period of life, the youngest thirty-five years and the oldest fifty-three years. There was nothing in the occupation or in the station of life of any moment. The features may be considered in detail.

*Cyanosis.* Naturally this attracts most attention and has been the feature which has led to further investigation. As is usual in all forms of cyanosis, it is most marked about the face and hands, but in Dr. Lowman's case and in both of my patients the skin of the entire body was a dusky blue. When first seen the suffusion of the conjunctivae and the prominence of the eyes, as in Case I., may add to the startling appearance of the patient. The cyanosis is more intense in cold weather, and is aggravated by any existing bronchial catarrh. On bright, clear days, with

but little moisture in the air, it may lessen (p. 197) greatly, as in Case I. The period over which the cyanosis has been noticed varies from ten years (Case V.) to three or four years (Case I.). While constant, as a rule, it may vary greatly in intensity. In Case II. the patient usually came in very deeply cyanosed, the condition aggravated, no doubt by the vomiting and the loss of liquids, but after a few days, when the bowels were moved, the color became less intense; but I saw this patient only the other day, some six weeks after his last attack of nausea and vomiting, and he was intensely cyanosed. There is no respiratory distress with the cyanosis. While the skin looks full and tense and the face and hands bloated, yet marked dilatation of the larger superficial veins is not noted. On close examination of the skin, many fine, dilated venules are seen.

*Blood.* The viscosity is greatly increased. All observers have remarked not only upon the unusually dark, but upon the thick and sticky character of the blood drop. An extraordinary polycythaemia is a special feature of the affection. The maximum blood count was 12,000,000 per c.mm. in Cabot's second case.

In eight of the cases the count was above 9,000,000 per c.mm., and in the ninth (Case IV.) it was 8,250,000 per c.mm. There have been no measurements of the red blood corpuscles. The statement is made that in the polycythaemia of congenital heart disease the red blood corpuscles are smaller than in that of high altitudes. The percentage of haemoglobin has been high, ranging to (in Case V.) 165. Usually the range has been from 120 to 150. In Case IV. it is stated to have been above the scale. The specific gravity of the blood in Case V. was 1080, and in Case II. it ranged from 1067 to 1083. In eight of the cases the leucocyte count ranged from 4000 in Case I. to 20,000 in Case VI. As a rule, in a majority of the cases it has been below 10,000 per c.mm. In case II. on one admission the count reached 30,000 per c.mm.

*Spleen.* In seven of the nine cases the spleen was enlarged. In four of these the enlargement may be termed great, reaching nearly to the navel. In Case VI. there was no note. In Case II. it was not enlarged.

The liver was enlarged in Case V.

*Urine.* In seven of the cases a trace of albumin was noticed, with hyaline, sometimes granular, casts. In Cases V. and VII. there was no note on the urine. The specific gravity was usually low.

*Pigmentation of the Skin.* As might be expected from the prolonged existence of the cyanosis, the skin was noted to be pigmented in several of the cases (II., III., IV., VII., IX.).

*Symptoms.* The symptoms have been very varied. Most of the patients have complained of headache, weakness, and prostration. Headache was a prominent symptom in four cases, vertigo in four, constipation in four, pains in back and abdomen in three cases (p. 198). Attacks of nausea and vomiting were a special feature in Case II., and are mentioned as present in Case V. Cough and shortness of breath were each present in one case. Fever was not noticed in any of the cases. The pulse was noticed to be of high tension and the vessels sclerotic. There was no oedema of the skin. The torpor, mental and physical; the sensation of fulness in the head, with headache, vertigo, and in some cases nausea and vomiting, remind us of the symptoms to which mountain climbers and aeronauts are subject. Three of the cases were fatal. In Case IV. the patient died in collapse after a few hours of drowsiness. In Case VI. the patient died comatose, with cerebral hemorrhage. In Case IX. the patient became drowsy and died in coma. The autopsy in Case IV. showed the heart to be about normal, moderate emphysema of the lungs, with cyanosis and oedema and moderately enlarged spleen. In Case VI. there was passive congestion of all the viscera and hemorrhage from the middle meningeal artery. In Case IX. there was hypertrophy of the left ventricle, with congestion of the brain.

REMARKS. *Chronic cyanosis*, a common enough feature in clinical work, is met with:

1. In organic disease of the heart, particularly in congenital malformation, in chronic myocardial and tricuspid lesions in children and adults, and in cases of adherent pericardium.

2. In certain diseases of the lungs, particularly emphysema,

and in long-standing pulmonary tuberculosis of the fibroid type. Practically there are only two conditions in which patients walk into the hospital or into our consulting-rooms with extreme cyanosis, congenital heart disease, and emphysema.

3. In the methaemoglobinaemia of chronic poisoning with coal-tar products, as antipyrin and acetanilid, etc. In this condition, too, the patient may startle one by the markedly cyanotic appearance.<sup>1</sup>

There are a good many people whose normal condition is one of great fulness of the blood vessels of the skin, so that in cold weather there may be marked cyanosis of the ears and of the face. We all know the stout, hearty, full-blooded man with rubicund face—the type which has been well described by Clifford Allbutt in his *Lane Lectures*—a common one among draymen and in men of that class, who live much in the open air and who drink freely. In them cyanosis, though not necessarily present, may be very marked in the face and hands when the temperature is low. As a rule, the peripheral circulation is (p. 199) active and the normal condition is a vivid hyperaemia of the skin associated with dilatation of numerous small venules.

Cyanosis, local or general, indicates one fact—diminished oxygenation of the blood corpuscles. In the deepest cyanosis of the ear or of the finger-tip the blood count may not be above 5,000,000 per c.mm. Only recently Dr. Fitcher examined for me the blood of a red-faced, short-breathed Englishman, whose skin seemed fairly bursting with blood and whose fingers and ears were quite cyanosed. The red blood corpuscles were only just above 5,000,000 per c.mm. In the local cyanosis of Raynaud's disease the blood count may be very little above the normal. I have a patient at present in the wards in whom the blood count from the cyanosed foot ranges from 4,500,000 to 6,500,000; the count from the ears about 5,500,000 (Dr. Briggs).

<sup>1</sup> I am sorry I have not got a blood count in a case of this sort. As a rule, there is anaemia; in a remarkable case which I saw with Dr. T. R. Brown, the haemoglobin was only 50 per cent. Unfortunately no count was made of the red blood corpuscles. In the case of a physician with extreme cyanosis from long-continued use of antipyrin, a blood count was made, and I remember that the red corpuscles were not above normal, but I have not the actual figures.

A few weeks ago, in Dr. Brayton Ball's wards of the New York Hospital, I saw an interesting case of coma (which turned out to be due to a fracture of the skull) with the most intense localized cyanosis in the fingers of one hand, active, vivid red hyperaemia of the fingers of the other hand, and normal-looking blood distribution in the ears. The count, very kindly made for me by Dr. N. B. Foster, was practically normal and the same in all three situations. Contrariwise, the anomaly may be present (though I must say it is rare) of a red face and general superficial hyperaemia with a very low blood count. During this session there has been under my care in Ward E a patient with what we have termed *anaemia rubra*. With a blood count of about 2,000,000 per c.mm. from ear-tip or finger-tip, he was as red as a beet, and it was not until his blood had fallen to nearly 1,200,000 that he began to present a typical picture of pernicious anaemia. On admission, with his blood at a little above 2,000,000, and looking the healthiest patient in the ward, he had nucleated red blood corpuscles. In the cyanosis of emphysema and the ordinary forms of heart disease, the number of red blood corpuscles per cubic millimetre is not, as a rule, much increased, and rarely reaches the limit of polycythaemia, which, as suggested by Cabot, may well be placed at 7,000,000. Occasionally most extraordinary cyanosis occurs in adherent pericardium, as in a case reported by me (*Archives of Pediatrics*, 1896) and in the case reported by Lorrain Smith and McKisack (*Transactions Pathological Society*, London, 1902). In the latter the blood count was 6,000,000.

*Polycythaemia.* There are two classes of polyglobulism—*relative*, in which the condition is due to a diminution in the quantity of the plasma of the blood, and *true*, in which there is an actual increase in the number of blood corpuscles. Much work has been done of late years on the subject. Relative polycythaemia is very common. It may be caused by a deficient amount of fluids ingested, which possibly may be the cause of polycythaemia of the newborn; more frequently (p. 200) it is caused by loss of liquids either by (a) sweat; (b) diarrhoea (by far the most common); (c) increased diuresis. (d) In another group of

cases there is loss of liquids by secretion or transudation, as in narrowing of the pylorus with dilatation of the stomach, and in the constant loss of liquids from the blood in recurring ascites. It is interesting to note that in some of these cases the polycythaemia is of a high grade and may persist for months or even for years. It is not necessarily associated with cyanosis, as in cases of dilated stomach and in diarrhoea. There is also a toxic polycythaemia described in poisoning by phosphorus and carbon monoxide, which, too, is probably relative. The polycythaemia of vasomotor disturbances, such as has been determined by Becker, Thayer, and others after the cold bath and after violent exercise, also comes in this class. Where the much-discussed polycythaemia of high altitudes should be placed is by no means certain. While a number of observers hold that there is new-formation, the lack of oxygen acting as a stimulus, others believe that it is relative, and due to increased elimination of fluids from the body, or that it is entirely due to a large number of corpuscles in the peripheral circulation. Others, again, think it is entirely due to the effects of decreased atmospheric pressure. The microcytes, poikilocytes, and nucleated red blood corpuscles point to new-formation, but the question is still under discussion.

*True Polycythaemia.* Vaquez and his pupil, Quiserne (*Thèse*, Paris, 1902), limit to this class the condition in which with an increased formation there is a continued increase in the number of red blood corpuscles in the circulating blood. It is met with where there is difficulty in proper aeration of the blood, as in high altitudes, or in heart disease, congenital and otherwise; and also in the obscure cases of the form here under consideration. The polyglobulism is regarded as a mode of adaptation to the new conditions and a sort of functional reaction of the organism. Belonging to this group is the polycythaemia so readily studied in congenital heart disease, and described by Krehl, Gibson, and others. The figures often reach as high as 8,000,000 or 9,000,000, rarely so high as in the form discussed in this paper.

It is by no means easy to offer a satisfactory explanation of the polycythaemia with cyanosis here under consideration. It does not seem possible to connect it in any way with the moderate



grade of enlargement of the spleen, and yet there are one or two observations in the literature which are of great interest in this connection. Rendu and Vidal (*Bull. et mém. Soc. méd. des hôpitaux*, 1899, 3 s., xvi. 528) report the case of a policeman who had an attack of vomiting without apparent cause, with dyspnoea. The temperature was normal. Red blood corpuscles, 6,200,000; leucocytes, 6000. This count gradually (p. 201) diminished. On examination, skin subicteric; cyanosis of face and hands marked, to a less degree all over the body. A tumor, evidently the spleen, reaching from diaphragm to iliac crest. Eventually ulcers developed on tongue and the liver became enlarged. Autopsy: Spleen adherent to diaphragm, fibrous on section, and filled with caseous masses.

Moutard-Martin and Lefas (*Société des hôpitaux*, 1899) have also reported a case of a woman, aged forty-nine years, with pain in the left hypochondriac region, emaciation, no ascites, no cyanosis, with enlarged spleen, slight albuminuria. The red blood corpuscles were 8,200,000, the leucocytes 31,428. At the autopsy the spleen weighed 750 grammes and contained large caseating nodules.

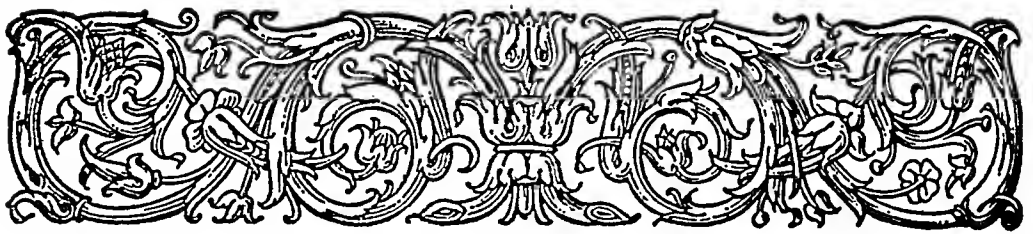
With our imperfect knowledge of the physiology of polycythaemia it would be premature to discuss at any length the pathology of this remarkable group of cases. We need:

1. A careful study of all forms of chronic cyanosis with polycythaemia, particularly those associated with heart disease and emphysema. (It is to be noted that the cases here reported have the highest blood count on record, much higher than the average in congenital heart disease or in dwellers at great altitudes.)
2. A more accurate study of the blood in this class of cases—the volume, the viscosity, the state of the plasma and the serum, the amount of haemoglobin, the specific gravity, and the diameter of the corpuscles. As increased viscosity of the blood, with resulting difficulty of flow, seems the most plausible explanation of cyanosis, it is especially important to test the viscosity by accurate physical methods and to determine the relation of the number of corpuscles to the viscosity of the blood.

3. The relation of the splenomegaly to the cyanosis and polyglobulism should be carefully observed. It may not be anything more than the effect of the chronic passive congestion.

Future investigation will determine whether we have here in reality a new disease. The clinical picture is certainly very distinctive; the symptoms, however, are somewhat indefinite, and the pathology quite obscure.

THE END



# On Multiple Hereditary Telangiectases with Recurring Haemorrhages

BY

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**S**TRICTLY speaking, telangiectasis is a dilatation of the terminal vessels, i.e. of the capillaries, but we use the term also to describe dilated venules. While applied most correctly to the congenital condition, the term naevus is sometimes used for the acquired form. Telangiectases occur on all parts of the skin. We see them under the following conditions: (1) On the cheeks, the nose, and the ears in persons who are exposed to the weather, and in heavy drinkers; but this Rosacea, as it is called, may be present also in young persons and be a source of much distress. A very interesting form is that so often seen as aborescent, distended venules on the skin of the thorax along the line of the attachment of the diaphragm.

2. Small pinkish spots from two to five millimetres in diameter, perfectly smooth and uniform, without visible venules, which disappear completely on pressure. These may be not more than a pin point in size, and they often have a vivid pink colour. They may appear suddenly and last for several years and then disappear.

3. The small nodular forms, raised and of a bright crimson or purple colour, varying in size from one to five millimetres. They may be congenital, and there are few bodies on which they are not seen, but with the patches of pigmentation and the yellow, plaque-like warts they form common senile changes in the skin of every one above sixty years of age. A point of interest is their supposed connexion with cancer of the abdominal organs, particularly of the stomach, but they are so common in old persons and in so many different conditions that the association is probably only accidental.

4. The spider form, made up of a central dot, sometimes raised and nodular, from which radiate five or six venules, or more correctly, towards which these vessels converge. This the so-called *naevus araneus*, is seen on the skin of the eyelids and on the cheeks of children and young girls, and by its vivid colour may be very disfiguring.

The most interesting association of the spider naevus is with cirrhosis of the liver. In no other condition may we watch the development of such remarkable telangiectases. The typical form in this disease is a plaque, ovoid or circular, two to three centimetres in diameter, of a pink or dark purple colour due (p. 54) to a diffuse dilatation of the capillaries, and across these plaques spider veins converge to a nodular centre. In some instances there are no visible veins, only a rosy red circular spot with a darker centre. On the forehead and cheeks there may be four or five. I have counted a dozen or more scattered over the arms and trunk. They do not appear to have any relation to jaundice. A remarkable circumstance is their complete disappearance without any change in the condition of the patient. They are met with also in organic disease of the liver, but are not so frequent as in cirrhosis, of which they may indeed be a diagnostic indication. One patient had troublesome bleeding from a spot, the nodule of which he had scratched. An interesting instance occurred in a medical student in connexion with an attack of catarrhal jaundice. A dozen or more of these spider naevi appeared on his face, and after persisting for three or four months gradually went away. Remarkable spider naevi occur

on the scars of the X-Ray burns, and they may appear in enormous numbers on the skin in scleroderma.

5. The mat form. Among the most remarkable acquired variety is that which may be well called by this name, as it represents a large area of the skin,  $1\frac{1}{2}$  to 4 inches in extent, which becomes involved in a capillary telangiectasis. At a distance the spot looks like an abrasion or an area of intense hyperemia, but on close inspection with a lens the smaller vessels of the skin are seen to be uniformly dilated. The colour is often of a vivid pink, but without the depth or intensity of the common birth-mark. This form, too, I have seen in cirrhosis of the liver and once in leukaemia.

6. The generalized, acquired telangiectases—the *télangectases essentielles en plaques* of the French—a form in which there appear in large numbers over the trunk or extremities numerous stellate venules. This is a rare form, of which only some fifteen or sixteen cases are on record. I have reported a case in the Johns Hopkins Hospital Bulletin for this year.

And lastly, *the multiple hereditary form with recurring hæmorrhages*, which is the special subject of this paper.

In the Johns Hopkins Hospital Bulletin, vol. xii, I reported the history of two brothers who had numerous telangiectases of the skin and mucous membrane, and who had had from childhood bleeding from the nose and from some of the spots. Seven members of the family had been subject to it. The bleeding had usually been from the nose, on the mucous membrane of which spider naevi could be seen. One of the brothers died under my care, and telangiectases were found in the mucous membrane of the stomach, as well as in that of the nose. The third case, reported in the same paper, has been under my observation on and off since 1896. He had had attacks of bleeding from the nose from his tenth year, and from the telangiectatic spots on the gums and lips. The bleeding has been profuse, and he has frequently had to have the nostrils plugged. I saw this patient last in January, 1907. He had only recently recovered from a severe attack. The appearance of his face was very much like that given in the coloured illustration of Dr. Kelly's patient (see

Plate 11), and the representation of part of his face is given in Plate 10. I had not seen him for (p. 55) three years, and, though very numerous, the spots were smaller and some of them had disappeared. One special change had occurred in the ten years he has been under observation, in the more nodular character of some of the spots, so that many now form definite naevi raised two or three millimetres above the level of the skin. No members of his family have been subject to the trouble. I have here to report another family, and shall analyse briefly the literature of a subject which has attracted some attention since the appearance of my paper in 1901.

*Family X.*—In the summer of 1904 I was called to New York to see a patient with Dr. —, aged 53, who had been in active practice for more than twenty-five years. I was at once attracted by his pallor, and the presence of numerous telangiectases of the skin of the face, ears, and lips, all of which stood out with great clearness on account of the anaemia. He stated that for years he had been a bleeder, chiefly from the nose, but also from the spots. The bleeding had begun at his tenth year, and it had been a source of constant distress from his youth. Though usually from the nose, he had bled from the spots on the skin of the face and of the head, once badly from a spot on the arm, and very frequently from the mucous membrane of the mouth. Within the past year the bleeding has been very profuse, scarcely a day passing without loss of blood. I saw at once the resemblance of the case to those I had already reported. I asked about the family history, and he said that he belonged to a bleeder family, that his grandfather, father, and one sister had had the spots, and had bled in the same way, and that his son, a young man of twenty, had had occasional epistaxis, but no spots. He regarded the condition as one of haemophilia. Fortunately, he fell into the hands of my friend, Dr. Coe, who has reported the case in the *Journal of the American Medical Association*, October 6, 1906. I saw Dr. — in January, 1907, and was at once impressed with the remarkable improvement in his appearance. He was no longer anaemic, the spots were much less marked, and he told me that by Dr. Coe's advise he had begun to take calcium

lactate, 20 grains three times a day, and he had had some of the more prominent spots on the face touched with the electric needle. For more than a year he had scarcely had any bleeding. The coagulation time, which had been to six or seven minutes, had been lowered to a minute and a half. He had gained in strength and weight, and felt in every way better than he had done for years. The other members of his family, who have been affected, have bled in just the same way from the spots alone or from the nose, never from the cuts, and have never had joint troubles as in ordinary haemophilics.

The telangiectases in this condition are of three sorts—the pin point, which may be readily overlooked and which may be numerous on the skin of the hands or of the face; the spider form, which is most common; and the nodular variety, which may gradually arise in the centre of a spider naevus and form a solid, vascular tumour the size of a split pea. The coloured illustrations here annexed show at a glance the very characteristic condition. I am much indebted to Dr. Kelly for allowing me to reproduce the illustrations of his case.

(p. 56) At least eight families, the subject of this peculiar affection have been recognized: *Family I.*—Wickham Legg<sup>1</sup>—Man aged sixty-five, in whom numerous naevi had appeared over the face and parts of the trunk; first noticed after his fortieth year. He had had epistaxis from boyhood, and had bled from slight traumatism. One sister, a son and a daughter had suffered from epistaxis. Legg reports the case as one of haemophilia. *Family II.*—Chiari<sup>2</sup>—The case of two sisters with multiple telangiectases of the skin and mucous membrane. They had also relatives who were subject to epistaxis, and the sisters are said never to have bled much from cuts. I have not been able to consult Chiari's paper in the original as it is not in any of the libraries accessible. *Family III.*—Rendu—When I reported my paper the only cases at all similar that I could find are those reported by this author<sup>3</sup>—a man aged fifty-two, whose mother and

<sup>1</sup> Lancet, 1876, vol. ii, p. 856.

<sup>2</sup> O. Chiari, Erfahrungen auf dem Gebiete der Hals- und Nasenkrankheiten, S. 60 et seq., Wien, 1887.

<sup>3</sup> Gaz. des Hôpitaux, 1896.

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brother had been subject to epistaxis, was admitted in a condition of profound anaemia, having had for three weeks a daily recurrence. He had bled from the nose at intervals since the age of twelve. On the skin of the face and on the mucous membrane of the lips and mouth were numerous small telangiectases.

*Family IV.*—Kelly<sup>4</sup>—Two sisters with the characteristic telangiectases of the face and mucous membrane, recurring bleedings, usually from the nose. One sister bled from the spots on the tongue and lips. The elder sister died of syncope induced by a severe and persistent epistaxis.

*Family V.*—Hawthorne<sup>5</sup>—Woman, aged forty-nine, repeated epistaxis from childhood with multiple telangiectases. The father, the sister and the eldest daughter had small spots on the skin, and her nine children had had attacks of epistaxis, but apparently only one had had the spots. *Family VI.*—Parkes Weber<sup>6</sup>—The patient, a woman (shown at the first meeting of the Association of Physicians in May), aged sixty, presented very characteristic condition of the face and mucous membranes. She had had repeated bleedings from the nose, never from any of the other spots. The telangiectasis appeared when she was forty-two, 'a few years after the onset of the epistaxis. The mother had epistaxis, and spots on her face. Of the patient's nine children three sons and one daughter have epistaxis, and two of the sons have multiple angiomas of the skin and mucous membrane.

*Family VII.*—Osler—Two brothers, aged fifty-five and fifty-seven. The father had had bleeding from the nose from boyhood. One sister had bled from the nose and one from both nose and mouth. The niece and the grandniece also had epistaxis. *Family VIII.*—Osler—The family here reported, four members of which have been affected. And lastly, there is the case of the man referred to in this paper, in whose family, so far as we know, there has been no epistaxis and no spots. I have not included the family reported by Babin-ton (*Lancet*, 1865, ii.) (p. 57) as the patients had only epistaxis, and there was no reference to telangiectasis.

The disease is one of very serious character, as the bleedings are

<sup>4</sup> Glasgow Medical Journal, June, 1906.

<sup>5</sup> Lancet, 1906, vol. i.

<sup>6</sup> Lancet, 1907, vol. ii.



often of great severity, and in some cases have recurred with such frequency that a state of chronic anaemia had been produced. My first patient, Mr. C., stated with his quiet humour that "he had been in the habit of bleeding to death", and on several occasions he returned to the hospital profoundly anaemic with swelling of the face and oedema of the feet. One of Dr. Kelly's patients died in syncope following a haemorrhage. In the great majority of the cases the bleeding is from the nose, and has the usual character of epistaxis. In other instances the blood comes from the spots on the lips, the tongue, gums, and mucous membrane of the palate. Only in a few instances has the bleeding been from the spots on the skin, and once from spots on the scalp. One of the cases bled severely from a spot on the arm.

From the nose the bleeding takes place spontaneously. It is easy to understand how the picking of the nostrils or violent blowing of the nose would cause rupture of the dilated, thin-walled vessels. In one of my cases a section of the mucous membrane of the septum was made, and a large number of dilated veins were found just beneath the epithelial layer. From the lips, tongue and gums a slight traumatism in the act of eating is the usual cause. It is more particularly when a central portion of the spider naevus is raised as a small nodule that the bleeding is likely to occur. In one of the cases there were a dozen round foci, each from three to four millimetres in diameter, in the mucous membrane of the stomach, but though cancer was present, there had been no active haemorrhages. None of the patients appeared to have any tendency to spontaneous haemorrhages, except Wickham Legg's, and in this case there is only a general statement to this effect.

While the telangiectases may occur early in life, as in my third case, as a rule they are not noticed until later, and in other cases apparently they follow the epistaxis. It is quite possible that the condition of anaemia induced thereby may be a factor in the development of the angiomata, which certainly vary a great deal in size and even in number from time to time. In Case III of my series the patient stated that the spots were always less noticeable after he had had a freedom from severe bleeding for some months.

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When I last saw him in January of this year the spots on his face had diminished greatly in size.

That severe bleeding may occur from a small naevus is well known. I saw an instance in a case of chronic Bright's disease in which the patient bled from a little naevus on the lip. He subsequently had diffuse purpura. Dr. William Bligh,<sup>7</sup> of Caterham Valley, Surrey, reports the case of a man, aged thirty-two, who bled profusely from a small naevus on the left forearm. There were small spots on the neck, forehead and left wrist. On several occasions he had had severe bleedings from the tumors. Dr. Bligh has kindly sent me word that there is no trace of haemophilia in the family.

(p. 58) The treatment of the condition is important. At the outset it is probable that very careful cauterization of the stellate veins in the nostrils would prevent the haemorrhage. We tried this in one of our cases, and although the patient bled very profusely afterwards, losing within twenty-four hours 1,400 c.c. of blood, it seemed, however, to do good, as he had no severe epistaxis for many months. This patient had the ingenious device of a finger of a very thin rubber glove which he inserted into the nostril, and by means of a small bit of rubber tubing he blew out the finger, turned a tap and in this way successfully plugged the nostril. Calcium chloride was used in this case very freely without, I must say, any special benefit. The most successful treatment was carried out by Dr. Coe in the case reported in this paper. Certainly, the change in the patient's appearance was remarkable. Many of the spots on the face and lips had been touched with the electric wire, and, as I mentioned, the calcium lactate was given in large doses over a prolonged period. For a year he had enjoyed excellent health and had been free from bleeding. This plan of treatment should be carried out thoroughly in all the cases.

THE END

*Note.* The colored illustrations here referred to have not been reproduced.  
E. C. K.

<sup>7</sup> *Lancet*, 1907, vol. ii.



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FIG. 1. THOMAS SYDENHAM  
1624-1689

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## Thomas Sydenham

### BIOGRAPHY

- 1624 Born in September at Wynford Eagle, Dorsetshire, in a Puritan family.
- 1642 Age 18. Entered Oxford University (Magdalen Hall) but left after only a few months because of the impending civil war. Sydenham's family, being Puritans, belonged to that group, the Parliamentarians, which defied the Royalist Government threatening the Constitution. Sydenham's rôle during the War is not definitely known, but he is supposed to have fought as a cavalryman.
- 1646 Age 22. At the close of the war, began the study of medicine at Oxford, becoming interested in the profession on seeing his brother William treated by a Dr. Thomas Coxe.
- 1648 Age 24. Graduated with the degree of Bachelor of Medicine, and was soon afterwards installed as a Fellow in All Souls College in place of an expelled Royalist.
- 1651 Age 27. His medical studies being interrupted by the second civil war, Sydenham became a captain of cavalry. While in service he probably saw the need of a practical clinical education in the healing art without the speculative theorizing which was then popular.
- 1655 Age 31. Gave up his medical education, married and began to practice.
- 1659 Age 35. Is supposed to have spent a period of study at the famous school of Montpeleier, France, where he studied under the great Barbeyrac.



- 1661 Age 37. Moved to London and settled in Westminster.
- 1663 Age 39. Became a Licentiate of the Royal College of Physicians but was never elected to a Fellowship, possibly because he did not have a doctor's degree and because, during his life time, his fame was meager.
- 1676 Age 52. Took the degree of doctor of medicine at Cambridge as a member of Pembroke College, probably because in 1674 his son had become a student there.
1689. Age 65. Died December 29 at his house in Pall Mall, London. Buried on December 31 in St. James' Church, Westminster, his epitaph reading "Medicus in omne aevum nobilia" (A physician famed throughout the ages).

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(same) Amstelodami, apud H. Wetstenium, 1694. 18°, 5 ff., 3 l., 96 pp.

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(same) Complete method of curing almost all diseases, and

description of their symptoms. To which are now added five discourses of the same author, concerning the pleurisy, gout, hysterical passion, dropsy, and rheumatism. Abridg'd and faithfully transl. out of the original Latin. With short and useful notes on the former part; written by a late learned physician, and never before printed. London, T. Norris (and others), 1724. 6. ed. 16°, 5 p. l., 202 pp.

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## INTRODUCTION

When Thomas Sydenham, as a young man, was attending medical school at Oxford, he found that medicine had made very little progress from the days of Hippocrates and Galen. The ancient authorities still controlled medical practice and their writings were read by the professors twice a week to the medical students. The anatomy of Galen, which he had taken from swine, dogs and apes, was being supplanted by the human anatomy of Vesalius but, otherwise, medicine was still full of the superstitions and the speculative theory of the Middle Ages.

Sydenham probably saw the need of a practical and level-headed medical practice while he was serving in the Civil Wars. At the age of thirty-one he seems to have become so disgusted with medicine as it was being taught him that he gave up his medical education and began to practice. A few years later he moved to London where he became a famous and very active practitioner and at the late age of fifty-two, after finishing his medical education, he received the degree of Doctor of Medicine at Cambridge.

Sydenham devoted his time and efforts to a study of medicine as he found it in the sickroom. He had little patience with philosophical explanations of diseased conditions. He noted carefully symptoms and signs of disease as he met them. He followed the course of a sickness through to its conclusion and kept careful case records of his experiences. This work enabled him to describe diseased states as they developed before him. It is for this reason that Sydenham has become known as the "English Hippocrates."

Sydenham's first book, *The method of treating fevers*, was published in 1666. Within a few years he had published several books on his observations of disease in all its phases. In 1683 appeared his work on the gout, which disease Sydenham himself suffered. Garrison considers this work to be Sydenham's masterpiece and it is here reproduced in its entirety.

Sydenham recorded his experiences with dysentery, scarlet fever, measles, hysteria and a form of chorea or St. Vitus dance which is now called Sydenham's chorea. See paragraph 19 of his paper, *Schedula monitoria: an essay on the rise of a new fever*, which is republished here, for a description of the symptoms of this condition.

Sydenham advocated the use of Peruvian bark, cooling drinks in smallpox, steel tonics in chlorosis and the opiate laudanum which bears his name. He prescribed horse-back riding for consumptives and recommended fresh air in the sickroom. Sydenham is credited with being one of the main founders of epidemiology. He described the articular and muscular pains of dysentery

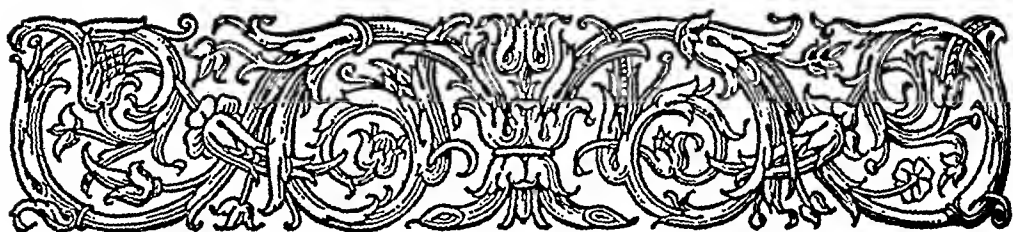
in 1672 and its seasonal aspects during 1669-1672 and in 1676. In 1675 he gave a full account of scarlatina as it had prevailed in London from the year 1661, separated the disease from measles and identified it by its present name.

Sydenham believed that the final causes of natural phenomena including disease could never be understood by the human mind. It was, therefore, foolish to attempt to discover the ultimate cause of disease. The observation of a patient with careful scrutiny of the course of his malady was the important thing for a physician. Sydenham regarded disease as a developmental process, with its own definite history and its own definite course. Each disease fitted into a category and could be classified and described as the units of the plant world. Sydenham held the Hippocratic theory of concoction of the humours of the body with the subsequent discharge of the morbid material when recovery took place. He believed that contagious diseases are influenced by cosmic and atmospheric changes.

Today the fame of Sydenham rests upon his clinical study of disease and his first-hand description of their manifestations. It is for this reason that a republication of several of the writings of Thomas Sydenham are included in MEDICAL CLASSICS.

The papers here reproduced are taken from *The works of Thomas Sydenham, M.D., on acute and chronic diseases; with their histories and modes of cure. With notes, intended to accommodate them to the present state of medicine, and to the climate and diseases of the United States, by Benjamin Rush, M.D. Professor of the Institutes and Practice of Medicine, and of Clinical Practice, in the University of Pennsylvania*, Philadelphia, Kite, Johnson and Warner (et al.), 1815.





# Selections from the Writings of Thomas Sydenham

## OF ACUTE DISEASES IN GENERAL

**A**DISEASE, in my opinion, how prejudicial soever its causes may be to the body, is no more than a vigorous effort of nature to throw off the morbid matter, and thus recover the patient. For as God has been pleased so to create mankind, that they should be fitted to receive various impressions from without, they could not, upon this account, but be liable to different disorders; which arise either from such particles of the air, as having a disagreement with the juices, insinuate themselves into the body, and mixing with the blood, taint the whole frame; or from different kinds of fermentations and putrefactions of humours detained too long in the body, for want of its being able to digest, and discharge them, on account of their too large bulk, or unsuitable nature.

2. These circumstances being so closely interwoven with our constitutions, that no man can be entirely free from them, Nature provides such a method and train of symptoms, as may expel the peccant matter that would otherwise destroy the human fabric. And though this end would be more frequently obtained by these disagreeable means, were not her method obstructed through unskilfulness; yet, when left to herself, either by endeavouring too much, or not enough, the patient pays the debt of mortality: for it is an immutable law, that no generated being can always continue.

Constat aeterna positumque lege est,  
Constet ut genitum nihil. Boethius.

3. A little to exemplify this doctrine: What is the plague but a complication of symptoms to throw out the morbid particles (taken in with the air we breath) through the proper emunctories, by way of external abscess, or other eruptions? What is the gout, but the contrivance of nature to purify the blood of aged persons, and, as Hippocrates phrases it, to purge the recesses of the body? And the same may be said of many other diseases, when they are perfectly formed.

4. But nature performs this office, quicker or slower, according to the different methods she takes to expel the morbid cause. For when a fever is required to loosen the morbid particles from the blood, to promote their separation, and at length discharge them by sweat, a looseness, eruptions, or other similar evacuation; as this effect is produced in the mass of blood, with a violent motion of the parts, it follows, that the change to recovery or death, must be sudden, (according as Nature can conquer the morbid matter by a crisis, or is forced to submit) and that these efforts must be joined with violent and dangerous symptoms. And of this kind are all acute diseases, which come to their state with rapidity, violence, and danger. Now, in this way of speaking, all those diseases may be esteemed acute, which, with respect to their fits taken together, go on slowly, but with respect to a single fit are soon terminated critically, of which kind are all intermittent fevers.

5. But where the matter of the disease is such that it cannot raise the assistance of a fever, for its thorough discharge, or is fixed upon a particular part too weak to expel it; either on account of the peculiar structure of that part, (as in the palsy, where the morbid matter is fixed in the nerves, and an empyema, where it is discharged into the cavity of the breast) or through a want of natural heat and spirits, (as when phlegm falls upon the lungs weakened by age, or an habitual cough) or lastly, from a continual afflux of a new matter, whereby the blood becomes vitiated, and, by its vigorous endeavours to throw it off, overpowers and oppresses the part affected; in all these cases, the matter is slowly brought to concoction, or not at all; and therefore diseases proceeding from such indigestible matter, are what we

properly term chronic. And from these two contrary principles, acute and chronic diseases respectively arise.

6. As to acute diseases, of which I now design to treat, some of them proceed from a latent and inexplicable alteration of the air, infecting the bodies of men; and not from any peculiar state or disposition of the blood and juices, any farther than an occult influence of the air may communicate this to the body; these continue only during this one secret state or constitution of the air, and raging at no other time, are called epidemic distempers.

7. There are other acute diseases, arising from some peculiar indisposition of particular persons; but as these are not produced by a general cause, few are seized with them at once. These also appear in all years, and at any time of the year indifferently, some exceptions admitted, which I shall hereafter mention, in treating of this kind particularly. These I call intercurrent or sporadic acute diseases, because they happen at all times when epidemics rage. I will begin with epidemics, and chiefly propose to give a general history thereof.

## OF EPIDEMIC DISEASES

1. If one were to examine all the branches of physic, nothing, perhaps, would appear so surprising as the different, and perfectly dissimilar face of epidemic diseases; which do not so much relate to, and depend upon the various seasons of the same year, as upon the different constitutions of different years.

2. And this manifest diversity of these diseases still farther appears, not only from their proper and peculiar symptoms, but also from the different method of cure they respectively require. Hence it is clear, that these distempers, though to less accurate observers they may seem to agree in their external face, and certain symptoms in common, are, in reality, of very different and dissimilar natures. Whether a careful examination, such as, perhaps, could not be well made in the life of one man, might shew, that certain tribes of epidemic disorders, constantly follow others, in one determined series, or circle, as it were; or whether

they all return indiscriminately, and without any order, according to the secret disposition of the air, and the inexplicable succession of seasons, I am not certain.

3. This, however, I am convinced of from numerous careful observations, that the above mentioned kinds of diseases, especially continued fevers, differ so extremely, that the same method which cures in the middle of the year, may possibly prove destructive at the conclusion of it; and when I had once happily fallen upon a genuine method of treating any species of fevers, suitably to its nature, I always proved successful (proper regard being had to the constitution, age, and other particular circumstances of the patient) till that species became extinct, and a new one arose; when I was again doubtful how to proceed, and, notwithstanding the utmost caution, could scarce ever preserve one or two of my first patients from danger, till I had thoroughly investigated the nature of the distemper, and then I proceeded in a direct and safer way to the cure.

4. And though I have carefully observed the different constitutions of different years, as to the manifest qualities of the air, that I might from thence discover the causes of the so great dissimilitude of epidemic diseases, yet I must own, I have hitherto made no progress; having found that years perfectly agreeing as to the manifest temperature of the air, have nevertheless produced very different tribes of diseases; and vice versa.

5. The matter seems to stand thus: there are various general constitutions of years, that owe their origin neither to heat, cold, dryness, nor moisture; but rather depend upon a certain secret and inexplicable alteration in the bowels of the earth, whence the air becomes impregnated with such kinds of effluvia as subject the human body to particular distempers, so long as that kind of constitution prevails, which, after a certain course of years, declines, and gives way to another. Each of these general constitutions is attended with its own proper and peculiar kind of fever, which never appears in any other; and therefore I call this kind of fever stationary.

6. There are also certain particular constitutions of the same year, in which, though such kind of fevers as follow the general

constitution of the year, with regard to the manifest qualities of the atmosphere, may prove more or less epidemic, and rise either earlier or later; yet the fevers that appear in all years (which we therefore call intercurrents) do proceed from some one or other manifest quality of the air; for instance, pleurisies, quinsies, and the like, which generally happen when an intense and long continued cold is immediately succeeded by a sudden heat. It may therefore be, that the sensible qualities of the air have some share in producing those intercurrent fevers, which appear in every constitution of the atmosphere, but they do not cause the epidemics peculiar to the general constitution. And yet, at the same time, it must be acknowledged that the above-mentioned qualities of the air may more or less dispose the body to the particular epidemic disease; and the same may be affirmed of any error in the non-naturals.

7. Now it must be observed, that some epidemic diseases, in some years, are uniformly and constantly the same, appearing in almost every patient with the same train of symptoms, and going off in the same manner. From this kind, therefore, as the most perfect, the genuine history of epidemic diseases is to be taken.

8. On the contrary, in other years there are other distempers, which, though called epidemic, prove very irregular and dissimilar, as having no one fixed form, or constant appearance, but are extremely irregular, both as to the variety and dissimilarity of the symptoms, and the manner in which they proceed and go off. This great variety in epidemics happens from hence, that every constitution produces diseases considerably differing from those of the same kind that prevailed in other constitutions at another time; which not only holds true of fevers, but of most other epidemic diseases.

9. Nor is this all; for there is another subtilty of nature still behind, viz. that the same disease, in the very same constitution of the year, frequently appears in a various and dissimilar manner, as to the time of its beginning, state, and declension; which is an observation of such consequence, as to regulate the indications of cure.

10. Again, it must be observed, that all epidemics are of two sorts, viz. vernal and autumnal; and though they may possibly arise at a distant time of the year, yet they must be referred either to spring or autumn, accordingly as they approach thereto respectively: for sometimes the temperature of the air conspires so much with an epidemic disease, as to produce it before its time; and, on the other hand, it sometimes opposes it so much, as to make it appear later, even in persons disposed to receive it. When, therefore, I shall mention spring or autumn, I do not precisely mean the vernal or autumnal equinox, but take in a wider compass.

11. Some vernal epidemics appear early, as in January, and thence gradually increasing, come to their state about the vernal equinox, after which they gradually decrease, and at length disappear about the summer solstice, except, perhaps, in a very few instances. Of this kind I reckon the measles, and vernal tertians, which, though they rise somewhat later, as in February, do likewise disappear near the summer solstice; whilst others, rising in the spring, and daily increasing, come not to their state till about the autumnal equinox, after which they gradually decrease, and vanish at the approach of winter. Of this kind are the plague and the small-pox, in those years when either of them is the principal disease of the year.

12. The cholera morbus, which is of the number of autumnal epidemics, rises in August, and finishes its course in a month; though there are other diseases which arise at the same time, and run on to the winter; as autumnal dysenteries, tertians, and quartans; all which, however, notwithstanding the longer or shorter space they sometimes affect a few particulars, generally cease in two months.

13. As to fevers in particular, it must be observed, that the greatest part of them which are of the continued kind, have hitherto no names assigned them, as they depend upon the influence of a general constitution or state of the air; but the names whereby they are distinguished, are derived from some remarkable alteration made in the blood, or some other apparent symptom; whence they are called putrid, malignant, petechial,

&c. But as almost every constitution, besides the fevers it produces, eminently favours some remarkable epidemic disease, as the plague, small-pox, dysentery, &c. I should think that these fevers ought to derive their names from the constitution, as this tends more peculiarly to produce some one of these remarkable distempers, at the time they appear, rather than from any alteration of the blood, or particularly symptom; both which may equally accompany fevers of different kinds.

14. Intermittents, indeed, derive their names from the interval of two fits, and by this mark are sufficiently distinguished, provided regard be had to the two divisions of the year wherein they happen, viz. spring and autumn. And yet sometimes fevers are of the true nature of intermittents, without any visible sign to discover them by. So when autumnal intermittents enter and appear early, as in July, they do not presently assume their genuine form, as vernal intermittents generally do, but so far resemble continued fevers in all respects, as not to be distinguished, without a very strict examination; but at length, when the force of the prevailing constitution is a little weakened, they appear more genuine, and at the close of autumn, quitting their disguise, plainly manifest themselves to be intermittents either of the tertian or quartan kind, as they really were from the first; but if this be not carefully attended to, physicians will be deceived, to the disadvantage of their patients, by taking such kinds of intermittents for true continued fevers.

15. Again it must be carefully remarked, that as many of these diseases appear in the same year, some one or other of them rules over the rest, which rage less at the same time; so that this one increasing, the others decrease, and this diminishing, the others soon re-appear. And thus they prevail by turns, according as each is favoured by the disposition of the year, and the sensible qualities of the air; and that distemper which rages most violently about the autumnal equinox, gives its name to the constitution of the whole year: for whatever distemper then prevails over the rest, will easily be found to preside over them during that year; and to the disposition thereof all the then

reigning epidemics accommodate themselves, so far as their nature permits.

16. Thus, for example; when the small-pox prevails much, the fever of that year, which is less general, plainly partakes of the same inflammatory nature therewith; so that both distempers begin after the same manner, and are attended with a great similarity of the most peculiar symptoms, as manifestly appears from the great tendency to spontaneous sweats, and the discharge of saliva in both; and they only differ in the eruption of the pustules, and whatever depends thereon. Again: when dysenteries are the principal raging disease of the year, the fever of the same year bears great resemblance to the nature; excepting only that, in a dysentery, the morbid matter is discharged by stool, with a few symptoms thereon depending; for they both attack in the same manner; and in both cases Aphthae, and the like symptoms, are equally apt to appear, and indeed the dysentery we speak of, is the fever itself, with this particularity, that it is turned inwards upon the intestines, and discharges itself that way.

17. But it must be remarked, that this principal epidemic which rages about the autumnal equinox, and lays all waste before it, is checked upon the coming in of winter; whilst, on the contrary the lower class of epidemics, subservient, as it were, to that principal one, now chiefly rage, till the said reigning distemper of the year again prevails, breaks their force, and abolishes their very name.

18. Lastly, it must be observed, that whenever any constitution produces various species of epidemics, all these species differ in kind from those which have the same name, but are produced in another constitution. But how many peculiar species soever arise in one and the same constitution, they all agree in being produced by one common general cause, viz. some peculiar state of the air; and consequently how much soever they may differ from one another in appearance, and specific nature, yet the constitution common to them all works upon the subject matter of each, and moulds it to such a state and condition, that the principal symptoms (provided they have no regard to the par-



ticular manner of evacuation) are alike in all; all of them agreeing in this circumstance, that they respectively grow mild or violent at the same time. It is farther to be noted, that in whatever years these several species prevail at one and the same time, the symptoms wherewith they come on are alike in all.

19. Hence we may see how very various and subtile a method nature uses in producing diseases, which no one, I conceive, has hitherto traced in proportion to the dignity of the subject; and it appears from this short account, that as the specific differences of epidemic distempers, especially fevers, depend upon the secret constitution of the air, that those persons labour unprofitably, who deduce the causes of different fevers from the morbid matter gradually collected in the body; for it is evident that if any man in perfect health should remove to any part of our own country where an epidemic disease rages, he might in a few days be seized with it, though it is scarce credible that any manifest alteration should be made by the air in the juices of the same person, in so short a time.

20. Nor is it less difficult to lay down general rules for the cure of these fevers, or to fix certain limits for practice. Under so much darkness and ignorance, therefore, my chief care, as soon as any new fever arises, is to wait a little and proceed very slowly, especially in the use of powerful remedies; in the mean time carefully observing its nature and procedure, and by what means the patient was either relieved or injured; so as soon to embrace the one and reject the other.

21. In short, to reduce all the species of epidemics into classes, according to the variety of their appearances, to explain their peculiar signs, and point out a proper method of cure for each, is a very difficult task, and requires much time; and as they arise in no stated order of years, (at least this is not yet discovered) to procure a just collection of observations about them, would perhaps require more than the life of any one physician; yet this task, how difficult soever, must be performed, before it can be justly said we have done any thing considerable towards discovering the intricacy of these disorders.

22. But how shall we give an account of the distinct species of

epidemics, which not only, so far as appears, arise fortuitously, but also continue of the same kind for a single year, or some certain series of years; but in another year differ from each other specifically? The best method I can pitch upon is that which describes them through a competent number of years, in the same order in which they happened; and to do this at present, according to my ability, I will here deliver the history and cures of those epidemics which raged from the year 1661 to 1676, viz. the space of 15 years, and this according to the most accurate observations I have been able to make; for it seems to me impossible to do any thing to this purpose by endeavouring to assign their causes, as derived from the manifest qualities of the air; or from any particular indisposition in the blood and juices, unless so far as this may depend upon a secret influence of the air. And it would be still more impossible to set down the species of various epidemics, as arising from some specific alteration of the air, however easy this might seem to those who can affix the names of fevers to ill-formed notions, from the speculation of such alterations as may happen in the blood or juices by any particular degeneration of principles. By this means, indeed, whilst we depart from nature, which is always the best guide, and indulge ourselves the liberty of conjecture, we may make as many species of diseases as we please; though at the same time we take such a liberty as no one would easily grant to a botanist, who, in writing the history of plants, is obliged to abide by the testimony of the senses, and not indulge his talent at conjecture, however excellent he may be therein.

#### OF THE MEASLES OF 1670

1. In the beginning of January, 1670, the measles appeared as is usual, and increased daily till the approach of the vernal equinox, when it came to its height; after which it abated in the same gradual manner, and went quite off in July following. I intend to deliver an accurate history of this sort, so far as I was then enabled to observe it, because it seemed to be the most perfect in its kind of all those I have hitherto met with.

2. This disease arises and terminates at the times above

specified. It chiefly attacks children, and especially all those who live under the same roof. 1. It comes on with a chiliness, shivering, and an inequality of heat and cold, which succeeded alternately during the first day; 2. the second day these terminate in a perfect fever, attended with 3. vehement sickness; 4. thirst; 5. loss of appetite; 6. the tongue white, but not dry; 7. a slight cough; 8. heaviness of the head and eyes, with continual drowsiness; 9. an humour also generally distils from the nose and eyes, and this effusion of tears is a most certain sign of the approach of the measles; whereto must be added, as a no less certain sign, 10. that though this disease mostly shews itself in the face, by a kind of eruptions, yet, instead of these, large red spots, not rising above the surface of the skin, rather appear in the breast; 11. the patient sneezes as if he had taken cold; 12. the eyelids swell a little before the eruption; 13. he vomits; 14. but is more frequently affected with a looseness, attended with greenish stools; but this happens chiefly in children during dentition, who are also more fretful in this distemper than ordinary. The symptoms usually grow more violent till the fourth day, at which time generally little red spots, like flea-bites, begin to appear in the forehead and other parts of the face, which being increased in number and bigness, run together, and form large red spots in the face, of different figures; but sometimes the eruption is deferred till the fifth day. These red spots are composed of small red pimples, seated near each other, and rising a little higher than the surface of the skin, so that they may be felt upon pressing them lightly with the finger, though they can scarce be seen. From the face, where only they first appear, these spots extend by degrees to the breast, belly, thighs, and legs; but they affect the trunk and limbs with a redness only, without perceptibly rising above the skin.

3. The symptoms do not abate here upon the eruptions, as in the small pox; yet I never found the vomiting continue afterwards, but the cough and fever grow more violent, the difficulty of breathing, the weakness of, and defluxion upon the eyes, constant drowsiness, and loss of appetite, persisting in their former state. On the sixth day, or thereabouts, the eruptions begin to

dry, and the skin separates, whence the forehead and face grow rough, but in the other parts of the body the spots appear very large and red. About the eighth day those in the face vanish, and very few appear in the rest of the body; but on the ninth day they disappear entirely, and the face, limbs, and sometimes the whole body, seem as if they were sprinkled over with bran, the particles of the broken skin being raised up a little, and scarce cohering, so that as the disease is going off, they fall from all parts of the body like scales.

4. The measles therefore generally disappear on the eighth day; when the vulgar, deceived by the term of the duration of the small pox, affirm, that the eruptions are struck in, though in reality they have run through the course assigned them by nature, and they suspect that the symptoms which succeed upon their going off, are occasioned by their striking in too soon. For it is observable that the fever and difficulty of breathing increase at this time, and the cough becomes more troublesome, so that the patient can get no rest in the day, and very little in the night. Children chiefly are subject to this bad symptom; which comes on at the declension of the disease, especially if an heating regimen, or hot medicines, have been used to promote the eruption; whence arises a peripneumony, which destroys greater numbers than the small pox or any of its concomitant symptoms; yet notwithstanding, if this disease be skilfully treated, it is in no ways dangerous. These bad symptoms are likewise often followed by a looseness, which either immediately succeeds the disease, or continues several weeks after the disease and all its symptoms are gone off, with greater danger to the patient, by reason of the continual waste of spirits hence arising. And sometimes also, after using an exceeding hot regimen, the eruptions turn livid, and then black; but this happens only in grown persons, who are irrecoverably lost upon the first appearance of the blackness, unless they be immediately relieved by bleeding and a cooler regimen.

5. As the measles in its nature nearly resembles the small pox, so does it likewise agree pretty much therewith in the method of cure which it requires: hot medicines and a hot regimen are very

dangerous; they are frequently used by unskilful nurses to drive the disease from the heart. The following method succeeded best with me. I confined the patient to his bed for only two or three days after the eruption, that the blood might gently breathe out the inflamed and noxious particles, that are easily separable, through the pores, in a manner suitable to the nature of the disease; and allowed no more clothes nor a larger fire than he accustomed himself to when in health. I forbade all flesh meats, and permitted water gruel, barley broth, and the like, and sometimes a roast apple, for diet; and for drink, either small beer, or milk boiled with thrice its quantity of water. To relieve the cough, which almost always attends this disease, I ordered a draught of some pectoral decoction to be taken between whiles, with a proper linctus. But I chiefly observed to give diacodium every night, the distemper throughout, e. gr.

Take of the pectoral decoction, a pint and half; syrup of violets and maiden-hair, each an ounce and half; mix them together for an apozem, to be taken in the quantity of three or four ounces, three or four times a day.

Take of oil of sweet almonds, two ounces; syrup of violets and maiden-hair, each an ounce; fine sugar enough to make them into a linctus, to be taken often in a small quantity, especially when the cough is troublesome.

Take of black-cherry water, three ounces; syrup of white poppies, an ounce: mix them together for a draught, to be taken every night.

In children the dose of the pectorals and opiate must be diminished in proportion to their age.

6. This method seldom fails of curing, besides being preventive of every other symptom, which is not the necessary and unavoidable attendant of the disease: the cough is the most troublesome one, which, however, is nothing dangerous til the disease be gone off; after which, if it should continue a week or a fortnight, it may be easily cured by the use of the open air, along with proper pectorals; and indeed it generally abates by degrees spontaneously, and at length ceases.

7. But, if by using cardiacs and too hot a regimen after the

departure of the disease, the patient's life be endangered (which is a very common thing) by the violent fever, difficulty of breathing, and other symptoms that usually afflict such as have a peripneumony, I have with great success ordered even the tenderest infants to be blooded in the arm, in such quantity as their age and strength indicated. And sometimes also, when the disease has been urgent, I have not feared to repeat the operation; and in reality by bleeding, I have snatched abundance of children from imminent death. This disorder attacks children upon the departure of the measles, and proves so fatal, that it may justly be esteemed one of the principal ministers of death, destroying greater numbers than the small pox; nor have I hitherto discovered any other certain method of conquering it. Bleeding also cures the looseness, which, as we said, succeeds the measles; for as it arises from the effluvia of the inflamed blood, flowing into the intestines (as is likewise usual in the pleurisy, peripneumony, and other diseases caused by inflammation) and irritating them to discharge their contents, this remedy alone will relieve; as it makes a revulsion of those sharp humours, and likewise reduces the blood to a due temper.

8. Nor need any one be surprised at my bleeding young children, since, as far as I have hitherto been able to observe, it may be as safely performed in them as in grown persons. And indeed it is so necessary in the peripneumonic fever above-mentioned, and in some other disorders to which children are subject, that there is no curing them without it. For instance: how are children to be relieved without bleeding during dentition, in the convulsions happening to them in the ninth or tenth month, accompanied with a swelling and pain in the gums, whence the nerves are compressed and irritated, and the fits also proceed? In this case bleeding only is vastly preferable to all the celebrated specifics yet known: some of which prove detrimental by their adventitious heat, and whilst they are supposed to cure the disorder by some occult quality, increase it by their manifest heat, and destroy the patient. Not to mention at present the great relief which bleeding affords in the whooping cough in children, in which it far exceeds all kinds of pectorals.

9. What has been said of the cure of those disorders which immediately succeed the measles, may sometimes also hold good when the disease is at the height, provided the symptoms be occasioned by an artificial heat, if I may be allowed to use the expression. In 1670 I attended a maid-servant of Lady Anne Barrington, who had the measles, joined with a fever, difficulty of breathing, purple spots over the whole body, and many other dangerous symptoms, all which I ascribed to the hot regimen and medicines which had been too freely used. I directed bleeding in the arm, and prescribed a cooling pectoral ptisan to be taken often, by means of which, and a more cooling regimen, the purple spots and all the other symptoms went off by degrees.

10. This disease, as above-mentioned, began in January, and increased daily till the approach of the vernal equinox, after which it decreased gradually, and totally disappeared in July following, without returning again during the course of the years wherein this constitution prevailed, except that in the following spring it appeared in a very few places. And let this suffice for the measles.

#### OF THE MEASLES OF 1674

1. In January, 1674, there arose a different kind of the measles from that which began in the same month, in 1670, and yet it proved as epidemic, but was not equally regular, nor so constantly kept its several stages; for sometimes the eruptions came out earlier, and sometimes later; whereas in the other kind they always appeared on the fourth day inclusive from the beginning of the illness. Again, the eruptions here appeared first on the shoulders, and other parts of the trunk; but in the other species they first shewed themselves in the face, and by degrees spread over the rest of the body. In this species likewise I seldom found that the skin peeled off like branny scales upon the disappearance of the eruptions, which happened as certainly in the other kind as after a scarlet fever. Moreover, this sort proved more destructive, when unskillfully treated, than the former; for the fever and difficulty of breathing, which used to succeed at the close of the distemper, were more violent here, and resembled a peripneumony more. But though this species of the

measles was anomalous and irregular, with respect to the symptoms just mentioned, yet in general the description of that of 1670 agreed pretty well therewith; which need not therefore be repeated here. This kind also, like the former, increased till the vernal equinox, from which time it abated, and at length vanished, at the approach of, or soon after, the summer solstice.

2. As the method of cure differs little from that which is amply delivered above in the history of the measles, it is to be sought for there; and I will only give a single instance hereof in this place, according to my custom.

3. In February, 1674, the countess of Salisbury sent for me to one of her children in the measles, which the rest, to the number of five or six, soon afterwards caught, and I treated them all in the same manner. I ordered they should lie in bed for two or three days before the eruption, that the blood might breathe out through the pores the particles occasioning the distemper, which were easily separable from it. But I allowed them no more clothes, nor a larger fire, than they were accustomed to when in health. I forbade the use of flesh, and permitted them to sup water gruel, and barley broth, and between whiles to eat a roasted apple, and I gave them small beer, or milk boiled with thrice its quantity of water, for drink. I also prescribed a pectoral ptisan, as usual, to be drunk occasionally, as the cough proved troublesome. By this means they recovered in the short time wherein this disease ordinarily terminates, and were not seized with any symptom which is not common in the measles, throughout the course, or after the departure, thereof.

4. During the first two months in which this kind of measles prevailed, a kind of morbillous fever intervened in a few subjects, attended with some eruptions in the body, but especially in the neck and shoulders, resembling the measles, from which however they differed in being confined to the parts above mentioned, and not seizing the whole body. The fever also, though manifestly of the same kind, was more violent, and lasted fourteen days, and sometimes longer. It admitted neither bleeding nor glysters, being exasperated by both, but readily yielded to the method adapted above to the measles. And let this suffice for the measles.



## PROCESSUS INTEGRI:

OR

## COMPLETE METHODS OF CURING MOST DISEASES

## OF THE MEASLES

1. Children are chiefly subject to this disease; which hath the following symptoms: The first day they are seized with a chilness and shivering, and heat and cold succeed by turns;—the second day a perfect fever comes on, accompanied with great sickness;—thirst;—loss of appetite;—a white, but not a dry tongue;—a slight cough;—heaviness of the head and eyes, with a continual drowsiness;—a constant distillation from the nose and eyes, and an effusion of tears, which is the most certain sign of the measles. —These symptoms are succeeded by a sneezing, a swelling of the eye lids, immediately preceding the eruption, a vomiting and a looseness, attended with green stools, especially in children whilst they are breeding teeth. The symptoms increase till the fourth day, at which time, and sometimes on the fifth day, little red spots, like flea bites, appear in the forehead and face, which growing more numerous and large, run together, and mark the face with large red spots, which are composed of small red pimples, rising a little higher than the skin, and may be felt by pressing them lightly with the finger, but can scarce be seen. From the face, where only they first shew themselves, these spots extend to the breast and belly, and then to the thighs and legs; but in these parts they are large and red, and do not rise above the surface of the skin.

2. The symptoms do not abate upon the eruption in this disease, as in the small pox; the vomiting indeed does not continue afterwards, but the fever, cough, and difficulty of breathing increase, and the distillation from the eyes; the drowsiness and loss of appetite remain. On the sixth day, or about that time, the forehead and face grow rough, the eruptions begin to dry, and the skin separates; but in the other parts of the body the spots appear very large and red. About the eighth day they vanish in the face, and scarce appear in the rest of the body. On the

ninth day they disappear entirely, and the face, limbs, and sometimes the whole body, seem covered with branny scales; but the cough, fever, and difficulty of breathing, grow worse. A hot regimen in grown persons makes the eruptions turn livid at first, and then black.

Take of the pectoral decoction, a pint and half; syrup of violets and maiden hair, each an ounce and half; mix them together for an apozem, and let three or four ounces of it be taken three or four times a day.

Take of oil of sweet almonds, two ounces; syrup of violets and maiden hair, each an ounce; white sugar candy, enough to make them into a linctus, to be taken often in a small quantity, especially when the cough is troublesome.

Take of black cherry water, three ounces; syrup of white poppies, an ounce: mix them together for a draught, to be taken every night the distemper throughout; lessening or increasing the dose, according to the age of the patient.

3. The patient should lie in bed for the first two days after the eruption.

4. If a fever, a difficulty of breathing, and other symptoms resembling a peripneumony, succeed after the measles are gone off, bleed plentifully in the arm, and repeat the operation a second or third time; as there is occasion, interposing a proper interval between each: and continue the use of the pectoral decoction and linctus above described, together with the oil of sweet almonds by itself. About the twelfth day from the beginning of the distemper give a gentle purge.

5. The looseness succeeding the measles is cured by bleeding.

#### OF INTERCURRENT FEVERS

1. The observations of the preceding years, above delivered, sufficiently shew that some fevers are deservedly entitled stationary fevers; I mean such as arise from some peculiar constitution of a particular year not yet sufficiently known. Every one of these prevails in its order, and rages with great violence, having, as it were, the ascendant over all the rest during that continued course of years. Whether there are any other species besides those just mentioned, or whether they succeed each

other in a certain term of years in a constant and invariable order, or whether it be otherwise, I have not yet been able to discover. But there are also other continued fevers, which, though they sometimes rage less, and at other times more severely, yet because they are mixed with all kinds of stationary fevers, and likewise with each other indifferently in the same year, I conceive they should be called intercurrents. I shall in the following sheets communicate all that I have learnt from observation concerning the nature of these fevers, and the method of curing them: they are, the scarlet fever, pleurisy, bastard peripneumony, rheumatism, erysipelatous fever, the quinsy, and perhaps, some others.

2. But as all these diseases are, during their state, or at least were, accompanied with a fever, till it went off, the febrile matter being thrown upon some particular part, according to the nature of the distemper, I question not that the fever is to be accounted the primary disease, and that the other disorder, whence those diseases generally derive their name, are symptoms, which chiefly regard either the peculiar manner of the crisis, or the part principally affected. But provided the thing be agreed upon, I will not contend about names; though I take the liberty to call a disease by the particular name which pleases me best.

3. It must be observed, that as the stationary fevers, of which we have treated above, prevailed more or less epidemically, as we said, according as they were favoured by the constitution of years, resulting from a secret and inexplicable temperature of the air; so likewise did these intercurrents sometimes, but less frequently. For though they generally arise from some peculiar disorder of particular bodies, whereby the blood and juices are some way vitiated, yet sometimes they proceed mediately from some general cause in the air, which, by its manifest qualities, so disposes the human body, as to occasion certain disorders of the blood and juices, which prove the immediate causes of such epidemic intercurrents. As for instance, when a sharp frost, which has lasted a long time, and continues late in the spring, is suddenly succeeded with warmer weather, pleurisies, quinsies, and the like diseases usually arise, whatever be the general con-

stitution of the year. And because these diseases, which happen indifferently in all years, do sometimes rage as epidemically as those which continue only for a certain course of years, we chuse to call them intercurrents, in order to distinguish them from the latter.

4. But notwithstanding the considerable difference there is between these two kinds of fevers, with respect to the causes proceeding from the air, yet they frequently agree in other external and procatarctic causes. For not to mention infection, which sometimes communicates stationary fevers, and surfeits, which give rise to both stationary and intercurrent fevers, the manifest external cause of the greater part of fevers is to be sought for hence; either 1. a person hath left off his clothes too soon, or 2. imprudently exposed his body to the cold after being heated with violent exercise; whence the pores being suddenly closed, and the perspirable matter retained in the body, that would otherwise have passed through them, such a particular kind of fever is raised in the blood, as the then reigning general constitution, or the particular depravity of the juices, is most inclined to produce. And indeed I am of opinion, that abundance more have been destroyed by this means than by the plague, sword, and famine together; for if a physician examines his patient strictly concerning the first occasion of the disease, he will generally find it to proceed from one of these causes, provided it be of the number of those acute diseases we have treated of above. Upon this account I always advise my friends never to leave off any wearing apparel till a month before midsummer; and not to expose themselves to the cold after being heated by exercise.

5. But it must here be carefully remarked, that though the diseases I am now to treat under the title of Intercurrents, were most, if not all of them, essential diseases; yet frequently certain disorders happen in stationary fevers, resembling these intercurrents as to the phenomena, and likewise characterized by the same name, which however are manifest symptoms of those fevers. Now in this case they are not to be treated by the method which is to be used when they are essential diseases, but rather

by that which the fever requires, whereof they are now symptoms, which method is only to be slightly adapted to their particular cure; but, in general, great attention is to be had to the fever of the year, and to find out the easiest method of conquering it, whether by bleeding, sweating, or any other procedure: for if this be disregarded, we shall frequently mistake, to the great detriment of the patient. Should it be objected, that the disorders under consideration, which I term essential, are in reality only symptoms, I reply, that perhaps they may be symptoms with respect to the fever whereto they properly belong, but they are at least symptoms of fevers which always necessarily produce them. To exemplify this matter: in an essential pleurisy the fever is of such a nature, as always to deposite the morbid matter upon the pleura; in an essential quinsy, of such a nature as always to throw off the morbid matter upon the throat; and thus it happens in the rest: whereas, when any one of the above-mentioned diseases succeeds a fever that belongs to a particular constitution of years, and is dependent thereupon, it is then produced accidentally only, and no way necessarily: for which reason there is a remarkable difference between them.

6. But in order to distinguish rightly between essential and mere symptomatic disorders, it is of moment to consider that the same symptoms which accompany any particular stationary fever at the beginning, will likewise happen at the same time in a pleurisy or quinsy, when these are only accidental symptoms of such a fever. We had a proof of this in the above-mentioned symptomatic pleurisy, that succeeded the fever which prevailed in this winter of 1675. For all that were seized with the pleurisy were afflicted in the beginning with a pain in the head, back, and limbs, which were the most certain and common symptoms of all those fevers that preceded the pleurisy, and continued after that disease went off. Whereas when either of these intercurrents is the essential disease, it attacks in the same manner in all years indifferently, having nothing at all in common with the then prevailing stationary fever. Besides, all the symptoms that afterwards arise are more apparent, as not being concealed and perplexed by a mixture of other phenomena of a different

nature, and belonging to another fever. Again, the time of the year, wherein the greater part of essential intercurrents usually make their appearance, frequently points out the kind of disorders whereto they should be referred. But, lastly, he is best qualified to discover the diagnostic signs, both of these, and all other diseases, who, by daily and diligent observation, hath searched so intimately into their nature and symptoms, as at first sight to be able to distinguish the genus; though perhaps the characteristic differences of some of them may be so very subtle, that he cannot express them by words to another.

7. But as these different species of fevers, so far as I can learn by carefully considering their concomitants, and the method of cure, proceed from an inflammation of the blood, peculiar to every disease, I place the principal parts of the cure in cooling the blood. In the mean time I always endeavour to expel the morbid matter, by a method of cure, varied according to the nature of the disease, and which experience shows to be readily curative of the particular species thereof. In reality, whoever certainly knows how to expel the febrile matter, either by bleeding, sweating, purging, or any other more proper way, must have the best success in the cure of all fevers.

#### OF THE SCARLET FEVER

1. Though the scarlet fever may happen at any time, yet it generally comes at the close of summer, when it seizes whole families, but especially children. 1. A chilness and shivering come at the beginning, as in other fevers, but without great sickness; 2. afterwards the whole skin is covered with small red spots; which are more numerous, larger, and redder, but not so uniform as those which constitute the measles; 3. they continue two or three days, and after they are vanished, and the skin is scaled off, there remains a kind of branny scales, dispersed over the body, which fall off and come again for twice or thrice successively.

2. As this disease seems to me to be nothing more than a moderate effervescence of the blood, occasioned by the heat of the preceding summer, or some other way, I do nothing that may

prevent the despumation of the blood, and the expulsion of the peccant matter through the pores, which is quickly enough performed. Accordingly, I refrain from bleeding, and the use of glysters, which make a revulsion, whereby I conceive the noxious particles are more intimately mixed with the blood, and the motion, which is more agreeable to nature, is checked. On the other hand I forbear cardiacs, by the heat of which the blood may perhaps be put into a more violent motion, than so gentle and mild a separation as effects the cure require; and besides by this means a high fever may be occasioned. I judge it sufficient for the patient to refrain wholly from flesh, and all kinds of spirituous liquors, and to keep his room, without lying always in bed. When the skin is entirely peeled off, and the symptoms vanished, it is proper to give a gentle purge, suited to the age and strength of the patient. By this plain and manifestly natural method this disease in name only, for it is little more, is easily cured without trouble or danger; whereas on the contrary, if we add to the patient's evils, either by confining him continually in bed, or exhibiting abundance of cardiacs, and other superfluous remedies, the disease is immediately increased, and he frequently falls a victim to the over-officiousness of the physician.

3. But it should here be observed, that when epileptic convulsions, or a coma, arise in this disease at the beginning of the eruptions, which sometimes happened to children and young persons, it is highly proper to apply a large and strong blister to the neck, and immediately exhibit a paretic of syrup of white poppies, which is to be repeated every evening during the illness; and he must be directed to make use of milk, boiled with thrice its quantity of water, for his ordinary drink, and to refrain from flesh.

## SCHEDULA MONITORIA:

OR

## AN ESSAY ON THE RISE OF A NEW FEVER

To

Dr. Charles Goodall,  
Fellow of the College of Physicians

As soon as I came to a resolution of publishing my late remarks on the fever of the present constitution, I thought myself obliged to dedicate the performance to you, principally, for two reasons. The first is, because you are my intimate friend, and have constantly defended me against all my opponents; not so much for my own sake, as out of an inherent generous disposition, and great integrity of mind, which induced you to support me in what you knew was truth, though at a time when most of the faculty exclaimed against me.

I ought not however to be, nor indeed am I, offended with them; for as many vile pretenders to the art of medicine, by extolling their fanciful speculations, in order to increase their reputation, have so frequently imposed upon mankind, it was altogether becoming wise and ingenious men not to admit hastily, and without a previous examination, the particulars delivered by me, which were very opposite to the received method of practice. Notwithstanding this, as I am not less indebted to you, I judge it my duty to make you a publick acknowledgment; gratitude being the distinguishing mark of a great and noble soul. The other reason of my addressing this treatise particularly to you, is the intimate acquaintance and correspondence which have existed between us for several years, whence you must needs be the best judge of the pains I have taken to collect the observations I have already published, relating to the history and cure of various diseases. And though they were printed separately, and at the distance of some years from each other, according as I came at the knowledge of them, yet they are, in my opinion, so deficient and imperfect, that I ought rather to be ashamed of, than expect any reputation from them. But this



may at least be pleaded in my behalf, that though the space of thirty years, which I have diligently employed in observing diseases, should seem sufficient to give a person a completer knowledge of them that I have attained, yet I scruple not to affirm, that though the same compass of time is more than enough to perplex the mind with speculative and fictitious reasonings, borrowed from books, which contribute no more to the cure of diseases, than painting does to the improvement of navigation, yet four times the number of years would be too little even for a physician in full practice, to carry every branch of medicine to perfection. I have used my best endeavours to collect the most accurate observations and sent them to the press without delay, that the public might immediately reap the benefit of them, in case they contained anything of use: and having thus done my duty, my mind is at rest, and I am not at all solicitous what receptions my writings may meet with. To this give me leave only to add, that as a person who does not esteem them will do me no prejudice, so, whoever gives them but a single reading, will be but little the better for them.

But enough of this: and now, worthy Sir, let me intreat your kind acceptance of this performance, which I intend as a public acknowledgment of the great respect I bear you, in which others also join with me, who are less acquainted with your merit than I am. As I have not the least dependance upon you, I cannot justly be supposed to flatter you, by openly professing as I do (to speak within compass) that there is not a better physician living, and that I never knew an honester man.

It is my wish, that you may outlive me many years, and be at the head of the profession, not so much to raise a fortune for your heirs, (which in comparison with the subsequent reason, betrays more of the brute than the man) as to teach mankind the methods of overcoming those difficulties in curing diseases, which have hitherto perplexed the art of medicine, and hindered its improvement. And, in order to this, you may if you think fit, build upon the foundations I have laid, but yet, so as to correct, with your usual humanity, the mistakes I may possibly have made in my observations on the history and cure of any

particular disease, when any such shall appear manifest to you from a long course of experience. Nor will this be doing the least injury to the memory of one after his decease, who in his life time had nothing more at heart than the improvement of medicine, by whomsoever it was effected, not so much, indeed, by learned discourses on the nature of distempers (of which we have already too many) as by a certain and genuine method of curing them. Adieu, worthy Sir, and continue your friendship to

Your most obliged humble servant,

THO. SYDENHAM.

### SCHEDULA MONITORIA:

OR

### AN ESSAY ON THE RISE OF A NEW FEVER

1. Though my declining age, and a constitution much broken by long illness, might justly excuse me from any great application of mind, yet I cannot forbear my endeavours to contribute towards the health of others though at the expence of my own, by advertising my countrymen of the entrance of a new constitution which has given rise to a new and very different kind of fever from those which lately prevailed.

2. It must be remembered that intermittent fevers began first in autumn, in the year 1677, and increased daily, and became epidemic till they came to their state or height; and afterwards gradually decreased, so far as in the latter years of this constitution to appear so seldom, that they could scarce be reckoned epidemic. And for this reason it must also be observed, that the two last years of this constitution, now in its declension, were respectively attended with a very severe winter, especially the former, viz. in 1683, in which the cold was sharper, and lasted longer than the oldest person living remembered it had done before: for the Thames was frozen over so hard, as to bear the weight of carts, and booths with different sorts of merchandize, and vast crouds of people. Though the cold was neither so severe, nor lasted so long, the following year, namely, in 1684,

yet, as soon as it began to thaw in February 1685, the fever I intend to treat of here appeared, which I esteem a new sort of fever, and altogether unlike the fever of the eight foregoing years.

3. Now, whether the change of this constitution is to be ascribed to the alteration of the manifest qualities of the air, which happened during these two winters, I know not, as having observed that no alteration of the sensible qualities of the air, however different, have produced a new species of epidemic diseases; and that a certain succession of years, though they have differed from one another in their outward appearance and temperature, have, notwithstanding, all conspired in producing the same species of stationary fevers. Having, therefore, maturely considered these particulars, I concluded, as I have elsewhere remarked, that the change of a constitution depends principally on some secret and hidden alteration in the bowels of the earth, communicated to the whole atmosphere, or on some influence of the planets. It must, nevertheless, be noted, that upon the departure of the depuratory fever some time ago, a severe frost happened in the beginning of winter in 1664, which abated not till towards the middle of March, and was soon succeeded by a pestilential fever, and, in a short time afterwards, by the plague itself. But however this may be, the fever under consideration, which began at the above-mentioned period of time, namely, in February 1654, has spread itself all over England, both the last and this, had been much more epidemic in other places than at London.

4. When I was first called in this fever, I firmly believed it was not one of that species of fevers I call stationary, but rather of the class of intercurrents, which happen promiscuously in most years: so that I esteemed it the same kind of distemper as the bastard peripneumony, which I have described above; with this difference only, that this fever was sometimes not attended with those symptoms which characterized and distinguished that disease; as 1. a violent cough; 2. a severe head-ach in coughing; 3. a giddiness upon the least motion, and 4. a great difficulty of breathing; all which are the general attendants of a bastard peripneumony. But as my bookseller pressed me, at that time, to give a new edition of my writings, I judged it proper to publish

my conjecture by way of postscript, in which I now find I was mistaken; having, indeed, been led into it by the manifest likeness there appeared between this fever and the bastard peripneumony, which happens now and then every winter: but in the beginning of summer, which season commonly terminated those peripneumonic fevers, this fever was still continued, whence, soon perceiving my error, I was fully persuaded that this fever was to be referred to a new constitution.

5. This fever, from the justest observation I could make, was generally accompanied with these symptoms. 1. Intervals of heat and cold succeeding each other, and 2. frequently a pain in the head and limbs; 3. a pulse not much unlike that of a healthy person; 4. the blood taken away commonly resembling pleuritic blood; 5. a cough mostly, which, with the other concomitants of a mild peripneumony, goes off so much the sooner, as the disease comes on at the greater distance from winter; 6. sometimes a pain in the neck and throat in the beginning of the illness, but not so violent a one as in the quinsy; 7. though the fever be continual, yet it often increases towards night, as if it were a double tertian, or a quotidian; 8. lying always in bed, though with a few cloaths on, is dangerous; for the fever being thereby translated to the brain, a coma or phrensy soon succeeds. And to speak the truth, there is so great a tendency to a phrensy here, that it frequently comes on spontaneously of a sudden, without any such occasion, but rises not to such a height as it does in the small pox and other fevers: the patient being rather calmly, than furiously delirious, and talking wildly between whiles. 9. Petechiae, or eruptions, frequently appear, occasioned by an unseasonable use of cordials, and a hot regimen, and in young persons of a warm constitution purple spots, which are certain signs of a considerable inflammation both in this and all other kinds of acute diseases; 10. and sometimes such spots as are termed military eruptions come out all over the surface of the body, appearing much like the measles, only they are redder, and when they go off, do not leave branny scales behind them, as in that disease: though these eruptions do sometimes come out spontaneously, they are frequently driven out by the warmth of

the bed, and cordials. 11. The tongue is either moist or dry, according to the regimen which has been used; when dry, it is brown in the middle, and white round the edges; but when moist it is white and foul. 12. Sweat, likewise, depends upon the regimen; for if that be over-heating, it is in a manner viscous, especially about the head, and though it flows plentifully and universally, affords little relief; whence it follows, that such sweats are only symptomatic, not critical. The raising a sweat by medicine in the beginning of the distemper ordinarily translated the morbid matter, if not to the head, at least to the limbs. But when the fever has seized the head, and the phrensy prevailed, the signs of the former vanish, only the pulse beats sometimes quick and sometimes slow; at length, however, when the spirits are exceedingly hurried by wrong management, the pulse intermits with startings of the tendons and death soon follows:

6. As to the cure: those signs of the peripneumony which accompanied this fever at its rise, soon after the beginning of the winter, convinced me, as I said before, that it was to be referred to the class of peripneumonic fevers; and therefore I had immediate recourse to that method which I formerly recommended in the cure of a bastard peripneumony, in the postscript to my epistle on the dropsy. And, indeed, this method agreed pretty well with the few patients which my ill state of health suffered me to attend, and with others, also, who used it upon my recommendation. Whatever motive it was that induced me to follow this method, I have since considered the symptoms of this disease, and the temperateness of the last year, which succeeded the two hard winters (especially of the winter season, which, in reality, on account of its mildness, scarce deserved the appellation) and it appears manifest to me, that this fever is only a simple inflammation of the blood, and consequently, that the curative indications are to be entirely levelled at removing the inflammation by a suitable method, and medicines.

7. In order to this, I first direct ten ounces of blood to be taken away from the arm, and in effect, though the blood in this fever generally resembles pleuritic blood, yet it does not well bear

repeated bleeding. But if a difficulty of breathing, a violent pain in the head in coughing, and other symptoms of this kind, shew the great tendency of this disease to a bastard peripneumony, bleeding and purging are to be repeated, till the symptoms entirely disappear, as we have intimated above, in treating of the latter distemper: and this I would have carefully noted.

8. In the evening I lay a blister between the shoulders, and next morning exhibit this lenitive potion:

Take of tamarinds, half an ounce; the leaves of senna, two drams; rhubarb, a dram and half; boil them together, in enough spring-water, to three ounces; in the strained liquor dissolve manna and solutive syrup of roses, each an ounce: mix all together for a draught, to be taken early in the morning.

I order this draught to be repeated every other day, till three have been taken, and the following, or a like opiate, to be given at bed time after the operation.

Take of the distilled water of cowslips, two ounces; syrup of white poppies, an ounce; fresh lemon juice, two spoonfuls; mix the whole for a draught.

This I do to prevent a coma's coming on, from the disturbance of the spirits, which purging often occasions, by the tumult it raises in the blood and juices of persons in fevers; which symptom yields to opiates, though they seem to promote it. For this reason, as I durst not venture to give a purge in the comatous fever of 1673, I persisted in the use of glysters, well knowing, that purgatives did then immediately cause a coma, which might perhaps have been prevented, if I had thought of administering an opiate after the operation of a cathartic.

9. But on the intermediate days of purging an opiate must not be given at bed-time, for fear of stopping, or at least checking the operation of the purgative to be taken the next day, which usually happens, though it be given late. It is a rule with me, in this, or any other epidemic fever, to forbear purging in the beginning or state of the disease, unless bleeding has been previously used; and for want of attending to this rule of practice, or from acting contrary to it, abundance of persons have been

destroyed, especially children, as I have elsewhere observed by way of caution.

10. It must, nevertheless, be noted, that though all the above-mentioned evacuations ought in general to be used in the cure of this fever, yet young persons and children often recover soon after being once blooded and purged, and require no more purging, the fever being conquered by the first cathartice; whereas, on the contrary, it is sometimes necessary to purge oftener than we have intimated above; for it happens, though not frequently, that the patient relapses in a few days after recovering by this method, occasioned by a fresh supply of febrile matter, which, however, is soon carried off by repeating the purgative a fourth time: but a return of this fever, when it is treated by this method, seldom happens, unless it be caused by the aphthae, succeeding the former fever, now come to their height; which fever is, in reality, only symptomatic, and often accompanied with a hiccup at intervals, that continues also some days after the fever is gone off, and at length ceases spontaneously, as the patient recovers strength; which is well worth noting, inasmuch as the hiccup happening at the declension of this fever is no way dangerous, unless several medicines be over-officiously and ineffectually administered, in which case it proves fatal: but both the aphthae and hiccup, or either of them, if they do not go off spontaneously, but prove obstinate, readily yield to the bark; an ounce of it being made into an electuary, or pills, with a sufficient quantity of the syrup of red poppies, and taken in the manner I formerly directed in my epistle to Dr. Brady, drinking a draught of whey after every dose: I have found this the surest medicine in this case, provided it be not rendered ineffectual by the patient's keeping his bed, which too often happens.

11. On the intermediate days of purging, I sometimes prescribed the following, or the like remedies:

Take of the conserves of wood sorrel and of hops, each an ounce; conserve of barberries, half an ounce; cream of tartar, a dram; syrup of lemons, enough to make them into an electuary; of which the quantity of a nutmeg is to be taken

thrice a day, with six spoonfuls of the following julap after each dose:

Take of the distilled waters of purslein, lettuce, and cowslips, each three ounces; syrup of lemons, an ounce and half; syrup of violets, an ounce: mix the whole together for a julap.

Or,

Take of spring water, a pint; the distilled water of roses, lemon juice, and fine sugar, each four ounces; boil them together over a soft fire, till the scum be quite cleared away. Let three ounces of it be taken at pleasure.

I add no spirit of vitriol to any of these medicines, though it is very cooling, by reason of its remarkable stypticity, whence it is improper in all diseases requiring to be cured by purgatives; to say nothing here of the mineral nature of this spirit.

12. It frequently happens, especially in the declension of this fever, that the patient, when treated in this manner, sweats now and then spontaneously in the night, which greatly abates all the symptoms; but notwithstanding, as such sweats are not to be depended on, the above mentioned method must by no means be discontinued, because, if those sweats should be promoted longer, the fever, which had been in some measure checked by the preceding purgatives, will increase again. For, if the sweat be prolonged beyond that space of time, wherein the febrile matter, prepared by due concoction, is entirely carried off, the following sweats will do nothing but raise a fresh inflammation. Hence, though those sweats which flow spontaneously might perhaps be critical, with respect to the expulsion of the febrile matter to be carried off, yet the subsequent sweats may be only symptomatic, and so do more mischief than good. In short, the gentle warmth of the bed in the night seasonably favours the sweat which flows spontaneously at that time, and for this reason, the patient should have no more, nor thicker cloaths laid on him than he usually had when in health, and no heating medicines should be given to him, only let him lie later than ordinary the next morning, and afterwards pursue the methods of cure above delivered.

13. The diet in this case should be water gruel, or barley gruel,



and now and then a roasted apple, and after the second purge, weak chicken broth. I order small beer to be drank cold for common drink, and the white decoction, made by boiling an ounce of burnt hartshorn in three pints of spring water, afterwards straining off the liquor, and sweeting it with fine sugar.

14. I have elsewhere observed, that when the patient hath been twice purged, there is no necessity to forbid his eating chicken, and the like food of easy digestion; this indulgence being allowable on account of purging, which otherwise could not be granted. Again, after the last purge, provided the fever be somewhat abated, and not yet entirely degenerated into an intermittent fever, three or four spoonfuls of canary may be given every morning, and after dinner, and again in the evening, for some days, which may promote the recovery of the patient's strength, and prevent the fever fits.

15. As this kind of fever is more apt to seize the head than any I ever yet saw, and cannot be removed thence without great difficulty and danger, I advise my patients to lie without their cloaths only a-nights; but if they are so much debilitated by the disease that they cannot sit upright, I allow them to lie down upon the bed, or a couch, with their cloaths on, the head a little high: neither do I suffer a greater fire to be kept in the room, than they were used to whilst in health.

16. This regimen is not only to be strictly followed from the beginning, in all that have this fever, except in women seized with it a few days after delivery, but must be indispensibly enjoined, when the patient is attacked with a phrensy, petechiae, purple spots, or any other sign of a violent inflammation, occasioned by an over-heating regimen. For, in this case, neither bleeding, nor covering the patient thinly in bed, nor the use of any kind of cooling liquors, will remove the fever without sitting up in the day time, inasmuch as the heat of the surrounding air, included in the bed by the coverings, puts the blood into too violent a motion, and the supine posture of the body hurries it violently to the head. But in this fever, when a phrensy comes on from ill-management, it cannot be removed immediately, neither is it safe to attempt the cure by repeated bleeding and

purgings, beyond the limits prescribed, whereas it will at length go off at its own time, and spontaneously by means of the above-mentioned method. Nothing, however, second the removal of this symptom more than shaving the head, and therefore I always order it, without applying a plaister, but only a cap thick enough to supply the loss of the hair, or at least to keep the head warm. By this means the brain is greatly cooled and refreshed, so as by degrees to be able to overcome the heat occasioning the phrensy.

17. What hath been said of the phrensy is also applicable to the coma succeeding this fever, in which the febrile matter, as it happens in that disorder, is translated to the head, whence except the whiteness of the tongue, no signs of a fever appear, so that the patient seems perfectly free therefrom. In this disorder, therefore, as well as in the former, purgatives, sudorifics, blisters, and the like remedies, are not only unsuccessfully used, but do much hurt: for such evacuations oftener kill than cure here. Having, therefore, used the general evacuations of bleeding and purging, the cure of this disorder, though it may terrify the attendants, is to be trusted to nature and time. For though the patient should be afflicted with a stupor for some days, he will, nevertheless, at length recover his health, provided he be not constantly kept in bed, but is suffered to rise in the day time, and lie down on the bed, or couch, with his cloaths on. In the mean time, however, it is proper to shave the head, and towards the declension of the distemper, to give three or four spoonfuls of canary twice a day: but I have treated of this disorder at large in another place.

18. The physician must not be discouraged by the fever from making the above specified evacuations, though upon feeling the pulse he should perceive a starting, and a convulsive motion of the body, because both bleeding and repeated purging are absolutely required, and do service in some nervous diseases. To prove this, I shall relate what I have experienced in a certain kind of convulsion, which is usually called St. Vitus's dance, of which I have cured five persons by bleeding and purging at due intervals. And since this disorder opportunely falls in my

way, and manifestly confirms the truth of what I have asserted, I will say something concerning it.

19. This disorder is a kind of convulsion, which chiefly attacks children of both sexes, from ten to fourteen years of age. It first shews itself by a certain lameness, or rather unsteadiness of one leg, which the patient draws after him like an idiot, and afterwards affects the hand of the same side, which being brought to the breast, or any other part, cannot be held in the same posture a moment, but it is distorted, or snatched by a kind of convulsion into a different posture and place, notwithstanding all his efforts to the contrary. If a glass of liquor be put into his hand to drink, he used a thousand odd gestures before he can get it to his mouth; for not being able to carry it in a straight line thereto, because his hand is drawn different ways by the convulsion, as soon as it has happily reached his lips, he throws it suddenly into his mouth, and drinks it very hastily, as if he only meant to divert the spectators. As this disorder appears to me to proceed from some humour thrown upon the nerves, which, by its irritation, occasions such preternatural motions, I conceive that the curative indications are to be directed 1. to lessen those humours by bleeding and purging, and 2. to strengthen the nervous system. To answer these ends, I use the following method: First, I order seven ounces of blood to be taken away from the arm, or such a quantity, whether more or less, as best suits the age of the patient; next day I give half, or a little more, of my purging potion, according to his age, or his being easier or harder to be purged, and in the evening the following draught:

Take of black-cherry water, an ounce; compound piony water, three drams; Venice treacle, a scruple; liquid laudanum, eight drops: mix them together for a draught.

20. I order the purge to be repeated thrice, with the interposition of a day between each time of taking it, and the opiate to be given always in the evening after the operation. Afterwards I prescribe bleeding and purging, as before. And thus I bleed and purge alternately, till the patient has been blooded three or four times, and purged after every bleeding, as often as the strength will admit: for it is to be carefully observed, that there

must be a sufficient space allowed between every evacuation, that the patient may be no ways injured by them. On the intermediate days I prescribe the following remedies:

Take of the conserves of Roman wormwood, and orange peel, each an ounce; conserve of rosemary, half an ounce; Venice treacle, and candied nutmeg, each three drams; candied ginger, a dram; syrup of citron juice, enough to make them into an electuary; of which the quantity of a nutmeg is to be taken in the morning, and at five in the afternoon, drinking after each dose five spoonfuls of the following infusion.

Take of the roots of piony, elecampane, master wort, and angelica, each an ounce; the leaves of rue, sage, betony, germander, white horehound, and the tops of the lesser centaury, each an handful; juniper berries, six drams; the peel of two oranges; slice and infuse them without heat in six pints of canary, and strain it off as it is used.

Take rue water, four ounces; compound piony and compound briony water, each an ounce; syrup of piony, six drams: mix them for a julap, of which let four spoonfuls be taken every night going to bed, with eight drops of spirit of hartshorn. Apply a plaister of gum caranna, spread of leather, to the soles of the feet.

21. According as the recovery advances, the foot and hand grow more steady, so that the patient can bring the glass in a straiter line to his mouth, which certainly shews how much better he is. But though, to finish the cure, I do not advise bleeding more than three or four times at most, yet purgative and alterative medicines are to be used till the patient is quite well. And, because such as have once had this disease are very subject to a relapse, it is proper to bleed and purge them for some days about the same season the next year, or a little earlier than it first began. And I can hardly help thinking but the epilepsy in grown persons will yield to the same method, provided the remedies prescribed be properly adapted to the age of the several patients; though, having seldom met with this distemper, I have not yet made trial of it—But this by way of digression.

22. It sometimes happens in women subject to hysteric com-

plaints, when the cure hath been attempted by the evacuations above specified, that the fever continues even after bleeding and repeated purging. And in this case its continuance is manifestly owing to the commotion of the spirits, occasioned by the evacuations; and, consequently, if there be no signs of a peripneumony or inflammation about the vital parts, the curative indications are only to be levelled at quieting the tumultuary motion of the spirits: for which purpose a sufficiently powerful opiate must be given every night, and hysteric medicines taken twice or thrice a day. Of this kind are pills made of galbanum, asafetida, castor, and similar ingredients, and julaps of the same nature, of which I have set down some forms in my treatise on hysteric diseases. Farthermore, to recruit the strength, and suppress the vapours, it is necessary to allow such food, both of the solid and liquid kind, as is most palatable.

23. We have already observed, that this fever in the preceding, but especially in the current year, increased every day towards night, when a fit came on like that of an intermittent. The physicians, therefore, who have learnt from experience, that all such fevers as did in the least intermit, and those frequently which did not, throughout the course of years, from 1677 to the beginning of the year 1685, certainly yielded to the Peruvian bark, treated this fever with the same medicine. But, however rational this procedure was, it nevertheless did not ordinarily succeed so well as in the foregoing years: for having made the strictest inquiry I could into this matter, I found, that though the bark was given in great plenty, yet it so seldom cured the distemper, that I should rather ascribe the patient's recovery to some happy termination of it, than to the efficacy of the medicine: so entirely it seemed to have lost the effectually curative virtue it was possessed of in the years above specified, at least in respect of the fever under consideration, which resembles a quotidian, but in a genuine tertian, or an intermittent that comes every other day, the bark does as much good now as it ever did. Hence it clearly follows, that this fever totally differed from the fevers of the preceding constitution, inasmuch as the bark avails not at all now, and that it is likewise increased by

wine, cordials, and other heating things; all which agreed well enough with the use of the bark, and the fever itself.

24. It is farther to be noted, that this fever throughout the summer, especially of the present year, wherein it prevailed, did often shew itself, not so much by the distinguishing signs of a fever, as heat and restlessness, but by gripings, sometimes with, and sometimes without a looseness; whilst notwithstanding the fever of this season lurked under this disguise, in which the inflammatory exhalations of the blood were not driven as ordinarily to the habit of the body, but thrown off inwardly by the mesenteric arteries upon the viscera of the lower belly, or intestines, and sometimes upon the stomach, by the ramifications of the celiac arteries, which exhalations commonly occasion vomiting, especially soon after drinking, or eating. But though this fever lies concealed under the kind and form of the symptoms above enumerated, it must be treated by the general method we delivered above, in the same manner as if it had appeared in its own shape, and that with respect both to bleeding and repeated purging; only it must be observed, that when the fever affects the stomach so much as to prevent its retaining a draught, the greater pil. cochiae must be substituted instead of a lenitive potion, two scruples of which always makes its way through the bowels: but the pills must be taken at four in the morning, so that the patient may sleep after them, and at night an opiate exhibited in a large dose, viz. a grain and half of solid London laudanum, made into two pills, with as much mastich, or eighteen or twenty drops of liquid laudanum, in an ounce of small cinnamon water, or any other generous vehicle. The stomach being by this means strenthened, and not irritated by the smallness of the quantity, will be less apt to throw it up. But if the purging draught and diacodium can be retained in the stomach, they are to be preferred to the above-mentioned pills and the laudanum, because they produce their effect without heating the body so much as the pills.

25. And now having mentioned the gripes, I must admonish my readers of the great danger which I have frequently found attend the prescribing mineral waters in any kind of gripes,

looseness, or vomiting, or any other disorder suspected to proceed from a fever. For in a distemper of so subtle and spirituous a nature as a fever is, mineral waters invert the order of nature to that degree in every particular, that instead of the ordinary attendants of a fever, they occasion quite irregular symptoms, and in the mean time contribute not in the least towards the cure of the fever, as I have learnt from a long course of experience.

26. It must, however, be carefully noted, as it may be a means of snatching abundance of persons from imminent death, that, notwithstanding what hath been already delivered, when the gripes degenerate in a confirmed dysentery (which, besides the gripes is attended with a discharge of a slimy matter streaked with blood downwards) it is apparently very dangerous to treat the disease by that tedious method, which consists 1. in evacuating the humours, and 2. in smoothing their acrimony; not to mention the internal use of astringent medicines of various kinds and forms, and the injection of astringent and healing glysters between whiles; having learnt from experience that a dysentery is most expeditiously and certainly cured by checking the flux immediately by laudanum: for so violent is this disease, that if the purging be continued when it is confirmed, it is much to be feared it may be increased thereby, and by its wonderful ferment last longer, whatever methods are afterwards used; or, perhaps, prove fatal.

27. For this reason, as soon as I am called to a person in this distemper, I give twenty drops of liquid laudanum in plague water, aqua mirabilis, or the like vehicle, and order the dose to be repeated twice in twenty-four hours; or oftener, if, being given in this quantity and manner, it suffices not to ease the gripes, and check the bloody discharges downwards. But when these grow thicker, which is the first sign of the approaching recovery, and the symptoms are overcome, I reckon it safest for the patient to persist in the use of the above-mentioned medicine morning and night for some days, lessening the number of drops every day, till there is no more occasion for them. It must also be carefully observed, that I order the patient to lie longer in

bed after taking the opiate, because an erect posture soon disturbs the head, unless sleep be indulged long enough after it.

28. With respect to diet, if the patient hath been used to wine, I allow him canary well diluted with water, in which a crust of bread hath been boiled; which I order to be kept in readiness for that purpose, cold, in a proper vessel. The white decoction made with burnt hartshorn, boiled in spring water, drank plentifully, is also beneficial in this case. Barley gruel, or chicken broth, a poached egg, or any thing else of easy digestion, may serve for diet in the beginning of the disease. But, afterwards we may rise by degrees to stronger liquors, and a more copious and solid diet, lest too strict an abstinence should cause a relapse, or some other symptoms, the effects of inanition. It must, however, be noted here, that though laudanum alone overcame the dystentery of the present constitution, yet in those years wherein this disease is epidemic, and prevails more than the rest, it should seem proper to use those evacuations, which I have already set down in treating of the dysentery.

29. I proceed now to mention another case, where a cure can no more be immediately made by that method which suits the fever whence it proceeds, than in the confirmed dysentery just specified. Thus, for instance, the patient is sometimes seized with a chilness and shivering, and fits of heat and cold succeeding by turns, which certainly manifest an approaching fever, violent gripings come on suddenly, occasioned by the speedy translation of the febrile matter to the bowels, and, instead of being blooded and purged, according to our former directions, as he ought to be, he hath recourse to hot medicines, both internals and externals, in order to expel the wind, whence he conjectures the disorder proceeds; till at length the pain increases, and being by its long continuance deeply fixed in the bowels, begins to cause an inversion of their peristaltic motion (whereby, according to the law of nature, every thing should be protruded downwards) and a great inclination to vomiting; the disease now terminating in the iliac passion. In this case, I say, the physician can pursue the method of cure, which the fever, the primary cause of this symptom requires, no farther than to order a single bleeding in



the arm; inasmuch as all purgatives, how often soever repeated, soon become emetic, and by this means increase the inverted motion of the bowels; neither the strongest cathartics, nor the least part of them, being able to force their way through the intestines, and procure a stool.

30. Here, therefore, I conceive it most proper to bleed first in the arm, and an hour or two afterwards to throw up a strong purging glyster; and I know of none so strong and effectual as the smoke of tobacco, forced up through a large bladder into the bowels by an inverted pipe, which may be repeated after a short interval, if the former, by giving a stool, does not open a passage downwards. But if the disorder yields not to this remedy, it is necessary to give a stronger purgative, though the making way to these means be attended with extreme difficulty.

Take of the pills of two principal ingredients, thirty-five grains; sweet mercury, a scruple; balsam of Peru, enough to make the whole into four pills; to be taken in a spoonful of syrup of violets, drinking nothing after them, for fear of their coming up.

If these pills be thrown up, give twenty-five drops of liquid laudanum, in half an ounce of strong cinnamon water, immediately, and repeat the dose in a few hours; but as soon as the vomiting and pain of the bowels are abated by this remedy, give the above-mentioned purge again, for it will be kept down by the laudanum now, and at length finish its operation. If the vomiting and pain, however, should return as soon as the effect of the opiate is worn off, and the cathartic lodge in the body; then, laying aside all hopes of opening a passage this way, we must return to the use of the opiate before described, and repeat it every fourth or sixth hour, till the bowels be quite free from pain, and their natural motion downwards of course restored, when the cathartic, which had hitherto been stopt in the body by the opposite motion of the intestines, will operate in the usual manner; though the repeated use of opiates should seem to have a contrary effect. An instance of this I met with very lately in a gentleman afflicted with a violent iliac passion, which was afterward succeeded by aphthae, occasioned by an over-long

retention of the morbid humours, and rough purgatives in the habit; but they were readily enough cured by the Peruvian bark, and the frequent use of the following gargarism:

Take of verjuice, half a pint, syrup of raspberries, and ounce; and make a gargarism.

31. But when the passages have recovered their ordinary natural openness, purgatives may be omitted for some days, till the disturbance lately raised in the bowels be entirely quieted, which space of time may be advantageously enough allowed for diluting, cooling, and smoothing the sharp humours; which being done if the least signs of a fever still remain, purgatives must be exhibited every other day, as above directed.—And let this suffice for the cure of this disorder.

32. If a child be seized with the fever, two leeches must be applied behind each ear, and a blister behind the shoulders, and it must be purged with an infusion of rhubarb in beer. And if the fever seems to intermit after purging, give the julap made with the Peruvian bark.

33. It is farther to be noted, that though children are as subject to this kind of fever as grown persons, and consequently ought to be cured by the same method; yet less blood must be taken away, according to their age, to which purging likewise ought to be adapted, and perhaps need not to be so often used: the distempers of children and young persons frequently yielding to the first or second purge. Nevertheless, it should be well considered, whether the fever which is treated in this manner does certainly belong to this constitution, or is of a different kind; which ought likewise to be attended to with the same exactness in all constitutions of years. For it is commonly known that children are often seized with fevers from dentition, which are not easily distinguished from those of another kind. And, for my own part, I have been long dissatisfied with respect to the cure of these fevers; nor could I be persuaded, till of late years, that any of those who were committed to my care, were recovered so much by art as by accident, till having been often informed of the success of a medicine not very famous, but rather little esteemed for being in common use, I likewise ordered it, and found it

to escape death, reduces him to the mortification of taking a multitude of medicines, during the long continuance of the fever, to remove those symptoms which proceed from ill management, by attempting to cure it by an extremely hot regimen and heating medicines, which of its own nature requires the coolest of both kinds. And thus, while men of unsound judgment tie themselves up to follow rules of art, as they are falsely termed, despising the contradictory testimony of their senses, and perplexing the cure by their hurry and apprehension, they change a disease, which of itself goes off in a little time, (and easily yields) into a lasting and difficult disorder.

38. For these reasons, therefore, I hope I may assert, upon good grounds, that the method of cure above delivered, which consists in bleeding and purging, is the most effectual one to conquer most kinds of fevers. Sweating is indeed, properly speaking, nature's method of expelling the febrile matter, and best adapted to the end, whenever nature unassisted first digests the morbid matter, and after it is sufficiently concocted, carries it off gently through the pores; which successful manner of curing fevers by nature, having been often observed by practical physicians, the theorist thence took occasion to make this rule, that all fevers may, and ought to be cured only by sweating.

39. But admitting this conclusion, it is manifest that art, how nearly soever it may seem to imitate nature, cannot always certainly cure fevers by sweat. For 1. art is unacquainted with the manner of duly preparing the morbid matter for expulsion; and though this were no secret, yet there are no certain signs indicated its due preparation; whence the fittest time of raising a sweat must needs likewise be unknown. And sure none but an obstinate person will deny it to be highly dangerous to excite sweat inconsiderately before the due concoction of the febrile matter, as the translating the unconcocted matter to the brain must increase the distemper. Besides, as I have elsewhere observed, the judicious aphorism of Hippocrates, viz. "that concocted, and not crude matters are to be evacuated," seems to relate more to sweating procured by art than to purging. For a man must be but little conversant in the practice of physic, not

to know what numbers of persons are injured every day by old women and unskilful pretenders to medicine by this preposterous use of sudorifics; it being customary with them, when a person complains of chilness, and a pain of the head and bones, which are the general fore-runners of a fever, to put him to bed immediately, and use their utmost endeavours to promote sweat. But this ill-timed attempt is so far from preventing the fever, which might perhaps have gone off spontaneously, or upon taking away a little blood, that contrariwise, it is much increased thereby, and becomes a lasting and inveterate disease.

40. 2. It is farther to be observed, that as those sweats which appear spontaneously in the beginning of the fever are entirely symptomatic, and not at all critical, so those, likewise, which are forced out at this time by sudorifics, do generally forward the cure no more than the former, which avail nothing to this purpose. 3. Again, as the proper time of promoting sweat is not known, so neither can we tell how long we should persist in this way; for if the sweat be continued beyond the due time, that is, longer than is requisite to carry off all the morbid matter, the waste of those fluid particles which should serve to dilute and cool the blood, will be a means of prolonging and increasing the fever. Hence, therefore, the precariousness of this method appears; whereas, on the contrary, the physician hath it in his power to regulate the other method, which consists in expelling the febrile matter by bleeding and purging, as he shall judge most convenient. 4. Farthermore, this method deserves the preference for this reason, namely, because it will do no mischief, though it should fail of curing; whereas sudorifics are pernicious, unless they complete the cure: for the warmth of the body, when a person hath been kept in bed some time, contrary to his usual custom, not to mention cordials, which are always administered in this method of cure, disturbs the animal economy, and causes convulsive motions of the limbs, and other irregular symptoms, which cannot be described, because they do not come under the history of the disease, as is common in several symptoms in all diseases, but proceed originally from the tumult and disorder super-induced, which frequently oppress nature when the dis-

temper is treated according to this method: all which are ordinarily ascribed to I know not what malignity.

41. The invention of the term, or opinion of malignity, has been far more destructive to mankind, than the invention of gunpowder. For as these fevers are principally entitled malignant, which are found most inflammatory, hence physicians have recourse to certain cordials and alexipharmics, in order to expel the imaginary poison by the pores; for so it must be called, unless they had rather trifle about words, than propose in earnest what may be understood; and upon the same foundation they have adapted the warmest regimen and medicines to those diseases which chiefly require the reverse. This in reality appears manifestly enough in the cure of the small pox, which is one of the most inflammatory diseases, as well as of other fevers; physicians having, perhaps, been led into this mistake by the petechiae, purple spots, and the like symptoms; which in most subjects proceed originally from an inflammation super-induced upon the blood, already over-heated by the fever; because they seldom come out spontaneously, except in the beginning of the plague, or that sort of confluent small pox attended with the highest inflammation. In this kind, indeed, the purple spots shew themselves in different parts of the body, intermix with the eruptions at their coming out, and are accompanied at the same time with a flux of blood from the lungs or urinary passages, and a cough, if the fever be so high as to put the blood into a very violent motion, and cause it to burst the vessels, and empty itself into the cavities of the body. And though the purple spots in this fever proceed not from such a considerable heat of the blood, as that which occasions such bleedings, yet they are produced by the same inflammation, with this difference only, that it is not so violent, and when not accompanied with such a flux of blood (the only symptom in the small pox which hitherto baffles the art of medicine) easily yields to a cooling regimen.

42. But if it be inferred, that there is some malignity in the case, not only from the purple spots, but also from finding the symptoms of the fever milder sometimes than should seem agreeable to its nature, whilst notwithstanding, the patient is more debilitated than could be expected for the time; I answer that

all the symptoms only proceed from nature's being in a manner oppressed and overcome by the first attack of the disease, so as not to be able to raise regular symptoms, adequate to the violence of the fever; all the appearances being quite irregular. For the animal economy being disordered, and in a manner destroyed, the fever is thereby depressed, which in the true natural order generally rises high. I remember to have met with a remarkable instance of this several years ago in a young man I then attended; for though he seemed in a manner expiring, yet the outward parts felt so cool, that I could not persuade the attendants he had a fever, which could not disengage and shew itself clearly, because the vessels were so full as to obstruct the motion of the blood. However, I said, that they would soon find the fever rise high enough upon bleeding him. Accordingly, after taking away a large quantity of blood, as violent a fever appeared as I ever met with, and did not go off till bleeding had been used three or four times. And this may suffice, with respect to these particulars.

43. But if the reasons alledged be not sufficient to prove that I am certainly right in what I have asserted, yet if experience teaches me that this fever does not readily yield to sweating, it is enough for my purpose, since it is not reasoning, but experience, that shews what sorts of fevers will yield to, and ought to be cured by sweat, and what kind by other evacuations. And, indeed, no judicious person, who is sufficiently acquainted with the nature of men and things, would hastily embrace the sentiments of another person, though of the greatest authority in matters of mere speculation, not demonstrable by any certain experiment. Such a one should reflect, that there is so much difference and subtilty in arguments, that though a theory may be proposed by a person which shall appear to be founded upon such solid reasonings as to command the assent of all that are present, yet, soon after, another person of greater abilities, perhaps, coming to consider the hypothesis that seemed so well established, shews its inconsistencies, and clearly proves by more cogent arguments, that it is no more than an imaginary notion, not the least trace of it being discoverable in nature, and substitutes a new and seemingly more probable and artful hy-

pothesis in the room of it; which, notwithstanding, meets the same fate as the former, as soon as some third person, as much superior in parts to the second, as he was to the first, stands up to oppose it. And there will be no end of the dispute, till we come at length to him, who is arrived at the height of human knowledge: but the great difficulty of finding this person, and distinguishing him from the rest of mankind, will soon appear to any one, who is not so extravagantly vain, as to lay claim to the character himself. For, as it is no improbable supposition, that there is an almost infinite number of beings in those vast orbs placed above us in different parts of the firmament, possessed of much more penetration than weak men; so it is not certainly known, whether the brain, which is the repository of thought, may not be so formed by nature, that mankind cannot so clearly discover what is absolutely true, as what is best adapted to their nature. But we shall say no more to those physicians, who regulate their practice more by idle speculations, than experience founded on the solid testimony of the senses.

44. But if it be objected here, that this fever frequently yields to a quite contrary method to that I have laid down; I answer, that the cure of a disease by a method which is attended with success only now and then in a few instances, differs extremely from that practical method, the efficacy whereof appears both from its recovering greater numbers, and all the practical phenomena happening in the cure. Thus, for instance, abundance of persons have recovered of the small pox, notwithstanding their having been treated by a hot regimen and heating medicines; and, on the contrary, several have recovered by the opposite method. Now, by what means is this dispute to be decided; and which of the two methods is to be preferred? The surest way of judging in this case, I take to be this: if in pursuing the former method, I find that the more I heat the patient, the more I increase the fever, restlessness, delirium, and other symptoms; and, on the contrary, if it should appear, upon being moderately cooled, that he is so much the calmer and freer from the fever, and other symptoms; and farther, that by keeping the fleshy parts in such a degree of warmth as best suits with the rising and suppuration of the pustules, they grow larger and fuller than by

keeping him overhot: having, I say, thus stated both cases, I conceive it cannot be doubted which method merits the preference.

45. So I likewise, if I find, in the fever under consideration, that the more the patient is heated, the more he is disposed not only to a phrensy, purple spots, petechiae, and the like symptoms; but farther, that the fever by this procedure is attended with all sorts of irregular and violent symptoms: and, on the other hand, if it appears that another patient, by treating him according to the method here proposed, is quite free from these symptoms, reason shews that the latter method of practice is much the best; though both the subjects recover by such different treatment. But if more recover by this method than the other, the dispute is so much the more easily determined; which, however, I will not go about to decide, for fear of seeming too partial to my own opinions.

46. And these particulars shall suffice concerning this kind of fever; how long it will last I know not, and cannot tell but it may be some subtle and spirituous beginning of that depuratory fever, now abolished, which the dreadful plague succeeded. In reality, there are some phenomena which rather incline me to embrace this opinion, insomuch as not only intermittent fevers, especially quartans, still continue in a few places, but likewise some of those continued fevers do sometimes turn to intermittents, especially during this autumn; not to mention now the increase of this fever towards night, which a little resembles the fits of intermittents: and what farther confirms me in this sentiment is, that persons in this disorder are much subject to vomiting. I do not, however, pretend to absolute certainty in this point, for want of knowing how the depuratory fevers began, as I intimated before in the following terms: "How long this continued fever had prevailed, I cannot say, my time having been hitherto sufficiently taken up in observing the general symptoms of fevers, and not having yet found that fevers might be distinguished with regard to the various constitutions of different years, or the different seasons of the same year."



## A TREATISE OF THE GOUT AND DROPSY

THE DEDICATORY EPISTLE OF THE AUTHOR, TO DR. THOMAS SHORT,  
FELLOW OF THE COLLEGE OF PHYSICIANS

Worthy Sir,

I present you here with a short treatise of the gout and dropsy, instead of a larger work, which I had thoughts of writing, namely, the history of those chronic distempers especially, which I have often met with in my practice. But as my immoderate application to this work occasioned the severest fit of the gout I ever had, it was a caution to me to desist from my undertaking, though with reluctance, consult my health, and rest satisfied with having finished my essay on these two diseases; for the gout constantly returned, as oft as I attempted to go on with the work.

Be pleased, therefore, to accept this performance with all its faults, which is addressed to you for two reasons chiefly: First because you have readily acknowledged and asserted the usefulness of the observations I formerly published, (which some persons contemn) both before me and others; and, secondly, because in the mutual intercourse we have had in consultations, I have found your genius well adapted to the practice of physic. For though you excel in all kinds of literature, yet nature has rather intended you for a judicious practitioner, than an idle theorist; practice and speculation differing as much from each other, as trifles and matters of the greatest importance; so that if my observation be right, they seldom meet in one and the same person.

Your penetration, joined with a large and extensive practice, which have furnished you with an opportunity of making experiments, have placed you at the head of the faculty, and your affability will be a means of preserving the esteem you have acquired. If the following sheets be not disapproved by you (to whom they are inscribed) and a few worthy men, my friends, I shall little regard the censure of others, who are angry with me, purely because I dissent from their opinions, relating to diseases and the methods of cure. And this I cannot well help, because my natural disposition inclines me to spend that time

in thinking, which others employ in reading; and I am more solicitous, that all I deliver should be agreeable to truth, than to the sentiments of others; as setting lightly by public applause. And, indeed, provided I discharge the duty of a good citizen, and serve the public, to the prejudice of my private interest, what matters it if I gain no reputation thereby? For, upon due consideration, my endeavouring to secure a character, who am now advanced in years, will, in a little time, be like providing for a non-existence. For what will avail me after my decease, that the eight letters which compose my name, will be pronounced by those, who can no more frame an idea of me in their minds, than I am now able to conceive what kind of persons those will be, who can have no knowledge of their immediate predecessors, and will perhaps have a different language, and other customs, according to the vicissitudes and fluctuating condition of human affairs? To what purpose, therefore, should I concern myself about the opinions of others? For if I have improved the diagnostic and curative parts of medicine, and thereby entitled myself to some praise, I cannot long enjoy it; and, on the contrary, if my writings are not much liked by some persons, I scarce think I shall trouble the public with more, by reason of my ill state of health. In reality, my hand trembled so, that I was not able to write this short treatise I now publish, but was assisted in this particular (which I gratefully acknowledge) by Mr. John Drake, bachelor in physic, of St. Johns College in Cambridge, whose good nature and integrity render him an excellent friend; and whose natural and acquired endowments will make him highly useful to mankind, when he pleases to practise an art which he so well understands. I conclude, with asking your pardon for the trouble I may have given you in the performance of my duty, and desiring you to believe, that it entirely proceeds from the regard and esteem I bear you, who am, Sir,

Your most obedient servant,

THO. SYDENHAM.

London }  
May 21, 1683. }

## A TREATISE OF THE GOUT

1. There is no doubt, but men will conclude, either that the nature of the disease, which is my present subject, is in a manner incomprehensible, or that I, who have been afflicted with it for these thirty-four years past, am a person of very slender abilities, inasmuch as my observations, concerning this distemper and the cure thereof, fall short of answering their expectations. But notwithstanding this, I will faithfully deliver the remarks I have hitherto made, concerning the difficulties and intricacies respectively occurring in the history of the disease, and the method of cure; leaving the illustration thereof to time, the discoverer of the truth.

2. The gout generally attacks those aged persons, who have spent most part of their lives in ease, voluptuousness, high living, and too free an use of wine, and other spirituous liquors, and at length, by reason of the common inability to motion in old age, entirely left off those exercises, which young persons commonly use. And, farther, such as are liable to this disease have large heads, and are generally of a plethoric, moist, and lax habit of body, and withal of a strong and vigorous constitution, and possessed of the best stamina vitae.

3. The gout, however, does not only seize the gross and corpulent, but sometimes, though less frequently, attacks lean and slender persons: neither does it always wait till old age comes, but sometimes attacks such as are in the prime of life, when they have received the seeds of it from gouty parents, or have otherwise occasioned it by an over-early use of venery, or the leaving off such exercises as they formerly indulged to a great degree; and who besides have had a voracious appetite, and used spirituous liquors immoderately, and afterwards quitted them, of a sudden, for those of a thin and cooling kind.

4. When it seizes a person far advanced in years, for the first time, it never has such stated periods, nor proves so violent, as when it attacks a younger person, because 1. he generally perishes before the disease, accompanied with its natural symptoms, comes to its height; and 2. because the natural heat and vigour of the

body being abated, it cannot be so constantly and powerfully thrown off upon the joints. But when it comes on sooner, though it may not yet fix on one part, nor prove so severe, but affect the patient occasionally, keeping no certain period, giving only a little pain for a few days, and coming on and going off without any order; yet it increases gradually, and goes on regularly, both with respect to the time of its coming, and the continuance of the fit, and rages more violently in its progress, than in its beginning.

5. I will first treat of the regular gout, and next of the irregular one; whether occasioned by an unadvised use of improper remedies, or the weakness of the subject. The regular gout generally seizes in the following manner: it comes on a sudden towards the close of January, or the beginning of February, giving scarce any sign of its approach, except that the patient has been afflicted, for some weeks before, with a bad digestion, crudities of the stomach, and much flatulency and heaviness, that gradually increase till the fit at length begins; which however is preceded for a few days, by a numbness of the thighs, and a sort of descent of flatulencies through the fleshy parts thereof, along with convulsive motions; and the day preceding the fit the appetite is sharp, but preternatural. The patient goes to bed, and sleeps quietly, till about two in the morning, when he is awakened by a pain, which usually seizes the great toe, but sometimes the heel, the calf of the leg, or the ankle. The pain resembles that of a dislocated bone, and is attended with a sensation, as if water just warm were poured upon the membranes of the part affected; and these symptoms are immediately succeeded by a chillness, shivering, and a slight fever. The chillness and shivering abate in proportion as the pain increases, which is mild in the beginning, but grows gradually more violent every hour, and comes to its height towards evening, adapting itself to the numerous bones of the tarsus and metatarsus, the ligaments whereof it affects; sometimes resembling a tension or laceration of those ligaments, sometimes the gnawing of a dog, and sometimes a weight and coarctation, or contraction, of the membranes of the parts affected, which become so exquisitely painful,

as not to endure the weight of the clothes, nor the shaking of the room from a person's walking briskly therein. And hence the night is not only passed in pain, but likewise with a restless removal of the part affected from one place to another, and a continual change of its posture. Nor does the perpetual restlessness of the whole body, which always accompanies the fit, and especially in the beginning, fall short of the agitation and pain of the gouty limb. Hence numberless fruitless endeavours are used to ease the pain, by continually changing the situation of the body and the part affected, which, notwithstanding, abates not till two or three in the morning, that is, till after twenty-four hours from the first approach of the fit; when the patient is suddenly relieved, by means of a moderate digestion, and some dissipation of the peccant matter, though he falsely judges the case to proceed from the last position of the part affected. And being now in a breathing sweat he falls asleep, and upon waking finds the pain much abated, and the part affected to be then swelled; whereas, before only a remarkable swelling of the veins thereof appeared, as is usual in all gouty fits.

The next day, and perhaps two or three days afterwards, if the gouty matter be copious, the part affected will be somewhat pained, and the pain increase towards evening, and remit about break of day. In a few days it seizes the other foot in the same manner; and if the pain be violent in this, and that which was first seized be quite easy, the weakness thereof soon vanishes, and it becomes as strong and healthy as if it had never been indisposed: nevertheless, the gout affects the foot just seized, as it did the former, both in respect of the vehemence and duration of the pain; and sometimes, when there is so copious a peccant matter in the beginning of the fit, that one foot is unable to contain it, it affects both at the same time with equal violence; but it generally attacks the feet successively, as above remarked. When it has seized both feet the following fits are irregular, both with respect to the time of seizure and their continuance, but the pain always increases in the evening, and remits in the morning; and what we call a fit of the gout, which goes off sooner or later, according to the age of the patient, is made up of a number

of these small fits. For when this disease lasts two or three months, it is not to be esteemed one continued fit, but rather a series or assemblage of little fits, the last of which prove milder and shorter, till the peccant matter being at length quite expelled, the patient recovers; which, in strong constitutions, and such as seldom have the gout, often happens in fourteen days; and in the aged, and those that have frequent returns of the disease, in two months; but in such as are more debilitated, either with age, or the long duration of the distemper, it does not go off till summer advances, which drives it away.

During the first fourteen days the urine is high-coloured, and after separation lets fall a kind of red gravelly sediment, and not above a third part of the liquids taken in is voided by urine, and the body is generally costive during this time. The fit is accompanied throughout with loss of appetite, chillness of the whole body towards the evening, and a heaviness and uneasiness even of those parts that are not affected by the disease. When the fit is going off, a violent itching seizes the foot, especially between the toes, whence the skin peels off as if the patient had taken poison. The disease being over, the appetite and strength return sooner or later, according as the immediately preceding fit hath been more or less severe, and in consequence of this the following fit comes on a shorter or longer space of time; for if the last fit proves very violent, the next will not attack the patient till the same season of the year returns again.

6. In this manner does the regular gout, accompanied with its genuine and proper symptoms, appear; but when it is exasperated, either by wrong management or long continuance, so that the substance of the body is in a manner changed into supplies for the disease, and nature unable to expel it according to her usual way, the symptoms differ considerably from those just described. For, whereas the pain hitherto only affected the feet (which are the genuine seat of the morbid matter, which, whenever it attacks any other part, clearly proves either that the course of the disease is obstructed, or the strength gradually impaired), it now seizes the hands, wrists, elbows, knees, and other parts, no less severely than it did the feet before; for some-

times it renders one or more of the fingers crooked, and motionless by degrees, and at length forms stony concretions in ligaments of the joints, which destroying both the scarf-skin and skin of the joints, stones not unlike chalk, or crabs eyes, come in sight, and may be picked out with a needle. Sometimes the morbid matter is thrown upon the elbows, and occasions a whitish swelling, almost as large as an egg, which becomes gradually inflamed and red. Sometimes it affects the thigh, which seems to sustain a great weight, yet without much pain; but thence gaining the knee, it attacks that part more violently, depriving it of motion, so as to nail it in a manner to the same place in bed. And when it is necessary to move the patient, either on account of the restlessness of the whole body, which is so frequent in this disease, or some other urgent cause, it ought to be done with great caution, as the least contrary motion, or shock, may perhaps give pain, which is only tolerable for this reason, because it soon goes off. And, indeed, this moving of the patient, which should be performed with such care and tenderness by the assistants, is no inconsiderable part of the evils which attend the gout; for the pain is not very violent the paroxysm throughout, in case the part affected be kept quiet.

7. As the gout formerly did not usually come on till the decline of winter, and went off in two or three months; in the present case, it continues all the year, excepting two or three of the warmest summer months. And it is farther to be observed, that as the cardinal or general fit continues longer now than it did heretofore, so likewise those particular fits, of which the general one is made up, rage a longer time; for, whereas one of these did not last above a day or two before, it now, wherever it fixes, does not go off till the fourteenth day, especially if the feet or knees be affected thereby. To this may be added, that the patient on the first or second day after its coming, besides the pain, is afflicted with sickness, and a total loss of appetite.

8. In the last place, before the disease came to such a height, the patient not only enjoyed longer intervals between the fits, but likewise had no pains in the limbs, and the other parts of the body, all the bodily functions being duly performed; whereas now

his limbs, during the intermission of the disease, are so contracted and disabled, that though he can stand, and perhaps walk a little, yet it is very slowly, and with great trouble and lameness, so that he scarce seems to move at all; and if he endeavours to walk beyond his strength, in order to recover the use of his feet, the stronger they grow, and the less liable they are to pain upon this account, so much more does the morbid matter (not wholly dissipated during this interval) threaten the bowels, to the endangering the patient, as it cannot be so freely thrown upon the feet, which in this state of the disease are never quite free from pain.

9. Moreover the patient is likewise afflicted with several other symptoms; as a pain in the hemorrhoidal veins, nauseous eructations, not unlike the taste of the aliment last taken in, corrupting in the stomach, happening always after eating any thing of difficult digestion, or no more than is proper for a healthy person, together with a loss of appetite, and a debility of the whole body, for want of spirits; which renders his life melancholy and uncomfortable. The urine, which was before high-coloured, especially in the fits, and voided in a small quantity, now resembles that which is evacuated in a diabetes, both in colour and quantity; and the back and other parts itch much towards bedtime.

10. And when the disease is become inveterate, after yawning, especially in the morning, the ligaments of the bones of the metatarsus are violently stretched, and seem to be squeezed with great force by a strong hand. And sometimes, though no yawning has preceded, when the patient is disposing himself to sleep, he feels a blow of a sudden, as if the metatarsus were breaking in pieces by a large stick, so that he wakes crying out with pain. The tendons of the muscles of the tibiae are sometimes seized with so sharp and violent a convulsion, or cramp, that if the pain it occasions were to last only a short time, it could not be borne with patience.

11. But after many racking pains, the following paroxysms become less painful, as an earnest of the delivery which approaching death is about to give, nature being in part oppressed by the



quantity of the morbid matter, and in part by old age, so as not to be able to propel it constantly and vigorously to the extremities; but, instead of the usual external pain, a certain sickness, a pain in the belly, a spontaneous lassitude, and sometimes a tendency to a diarrhoea, succeed. When these symptoms are violent, they ease the pain of the limbs, which returns upon their going off; and the paroxysms are much prolonged by this alternate succession of pain and sickness. For it is to be observed, that when the disease has continued several years the pain diminishes gradually every fit, and the patient at length sinks rather from the sickness than the pain; which in these fits, though it be longer, is not near so violent as that which he usually suffered, when his strength was little impaired. But nevertheless, this violence of the disease was ordinarily recompensed by longer intervals between the fits, and the good state of health the patient enjoyed during the intermission. In effect, pain in this disease is the disagreeable remedy of nature, and the more violent it proves, the sooner the fit terminates, and the longer and more perfect is the intermission; and so on the contrary.

12. But besides the above-mentioned symptoms, viz. the pain, lameness, inability to motion of the parts affected, the sickness, and other symptoms above enumerated, the gout breeds the stone in the kidneys in many subjects, either 1. because the patient is obliged to lie long on his back, or 2. because the secretory organs have ceased performing their proper functions; or else 3. because the stone is formed from a part of the same morbid matter; which, however, I do not pretend to determine. But from what cause soever this disease proceeds, the patient is sometimes at a loss to know whether the stone or the gout be most severe. And sometimes a suppression of urine, caused by the stone's sticking in the urinary passage, destroys him, without waiting for the slow advances of its concomitant the gout.

13. The patient is not only reduced to this helpless condition, but to complete his misery, his mind, during the fit, sympathizes with his body, so that it is not easy to determine which of the two is most afflicted. For every paroxysm may be as justly denominated a fit of anger, as a fit of the gout; the rational faculties

being so enervated by the weakness of the body, as to be disordered upon every trifling occasion; whence the patient becomes as troublesome to others as he is to himself. Moreover, he is equally subject to the rest of the passions, as fear, anxiety, and the like, which also torment him till the declension of the disease, when the mind is restored to health along with the body, having recovered its former tranquillity.

14. To conclude: The viscera in time are so much injured, from the stagnation of the morbid matter therein, that the organs of secretion no longer perform their functions, whence the blood, overcharged with vitiated humours, stagnates, and the gouty matter ceases to be thrown upon the extremities as formerly, so that at length death frees him from his misery.

15. But what is a consolation to me, and may be so to other gouty persons of small fortunes and slender abilities, is, that kings, princes, generals, admirals, philosophers, and several other great men, have thus lived and died. In short, it may, in a more especial manner, be affirmed of this disease, that it destroys more rich than poor persons, and more wise men than fools; which seems to demonstrate the justice and strict impartiality of Providence, who abundantly supplies those that want some of the conveniences of life, with other advantages, and tempers its profusion to others with equal mixture of evil; so that it appears to be universally and absolutely decreed, that no man shall enjoy unmixed happiness or misery, but experience both: and this mixture of good and evil, so adapted to our weakness and perishable condition, is perhaps admirably suited to the present state.

16. The gout seldom attacks women, and then only the aged, or such as are of a masculine habit of body; for lean and emaciated women, who, in their youth or riper age, are seized with symptoms not unlike the gout, receive them from hysteric disorders or some preceding rheumatism, the morbid matter whereof was not sufficiently carried off in the beginning, nor have I hitherto found children, or very young persons, affected with the true gout. Yet I have known some who have felt some slight touches of it before they came to that age; but they were such as were

begot by gouty parents. And let this suffice for the history of this disease.

17. Upon a thorough attention to the various symptoms of this disease, I judge it to proceed from a weakened concoction both of the solids and fluids; for such as are subject to it, being either worn out by old age, or having hastened this period of life by their debaucheries, labour under an universal paucity of animal spirits, occasioned by the immoderate use of the vigorous function in the heat of youth. For instance, by a too early or excessive use of venery, by the vast and continual pains they take to gratify their passions, and the like: whereto must be added the quitting of such bodily exercises of a sudden as they had formerly used (whether through age or idleness) which served to invigorate the blood, and strengthen the tone of the solids; whence the strength decays, and the concoctions are no longer duly performed, but on the contrary the excrementitious part of the juices, which was formerly expelled by means of such exercise, lies concealed in the vessels to feed the disease. And sometimes the disease has been increased by a long continued application to some serious study; whereby the firmer and more volatile spirits are called off from their proper function of assisting the concoctions.

18. Again, such as are subject to the gout, besides having a voracious appetite in general, chiefly covet all kind of aliment that is hard of digestion, which, when they have eat as plentifully as they ordinarily did when they used exercise, they cannot digest. But this way of living does not occasion the gout so often as the excessive use of wine, which destroys the ferments designed for various concoctions, hurts the concoctions themselves, and overcomes and dissipates the natural spirits, by reason of the abundance of adventitious vapours. Now the spirits, which are the instruments of concoction, being weakened, and the blood over burdened with juices, at one and the same time, all the concoctions must needs be depraved, whilst all the viscera are so oppressed; whence the spirits that have long been in a declining state, are now quite exhausted. For if this disease proceeded only from a weakness of the spirits, it would easily

affect children, women, and persons debilitated by a tedious illness: whereas the strongest and most robust constitutions are chiefly subject to it, but not before the abundance of humours are collected in the body through the decay and waste of the natural heat and spirits, which in conjunction destroy the vitiated concoctions.

19. Again, as each of the causes we have enumerated promote indigestion, so most of them contribute in some measure to introduce a laxity of the habit and muscles of the body; which makes way for the reception of crude and indigested juices, as often as they are thrown upon the external parts. For when by lying long in the blood they are increased in bulk, and have gained an ill quality, they at length acquire a putrefying heat, and nature being no longer able to subdue them, become a species, and fall upon the joints, and by their heat and acrimony occasion exquisite pain in the ligaments and membranes that cover the bones; which being weakened and relaxed, either by age, or luxury and intemperance, easily admit them. But this translation of the humours occasioning the gout, and forming a gouty fit, happens sooner or later, according as these humours are occasionally put in motion.

20. I proceed now to the cure; in treating of which I shall first take notice of such things as are to be omitted. Now, in this disease, if regard be had to the humours, and the indigestion occasioning them, it should seem at first view that the curative indicature should principally tend 1. to evacuate humours already generated, and 2. to strengthen the concoction, or digestive powers, so as to prevent the accumulation of other humours, these being the usual indications to be answered in most other humoral diseases. But nevertheless in the gout, nature seems to have the prerogative to expel the peccant matter according to its own method, and throw it off from the joints, there to be carried off by insensible perspiration. Now there are only three ways proposed of expelling the morbid matter of the gout, namely, 1. bleeding, 2. purging, and 3. sweating: but none of these will ever answer the end.

21. 1. Though bleeding seems to bid fair for evacuating the

humours immediately to be translated, as well as those already fixed in the joints; yet it manifestly clashes with that indication which the antecedent cause, indigestion, arising from a depravity or paucity of the spirits, demands, which bleeding farther weakens and diminishes; and for this reason it is not to be used either by way of preventing an approaching, or easing a present fit, especially in the aged: for though the blood that is taken away generally resembles pleuritic or rheumatic blood, yet bleeding is found to do as much mischief in this disease, as it does good in those. And bleeding in the interval, though long after the paroxysm, is apt to occasion a fresh fit, by the agitation of the blood and juices, which may continue longer, and be attended with more violent symptoms than the former, the strength of the blood being impaired thereby, by means whereof the morbid matter should have been powerfully and constantly expelled. This inconvenience always happens from bleeding in the beginning of the fit; and if it be used immediately after the fit, there is great danger (on account of the present weakness of the blood, and its not having recovered its former strength, diminished by the disease) of debilitating nature so much by the unseasonable use thereof, as to make way for a dropsy. Nevertheless, if the patient be young and over-heated by hard drinking, a vein may be opened in the beginning of the fit: but if bleeding be always used in the succeeding paroxysms, it would render the gout inveterate, even in youth, and cause it to spread more universally in a few years than it otherwise would have done in many.

22. 2. With respect to vomiting and purging, it should be noted, that as it is a fixt law of nature, and interwoven with the essence of this disease, that the morbid matter thereof ought always to be translated to the joints, emetics or cathartics will only invite the gouty matter back into the blood, which was thrown off by nature upon the extremities; and hence what ought to be thrown upon the joints, hurries perhaps to some of the viscera, and so endangers the life of the patient, who was quite safe before. And this has often been observed to prove fatal to those who have ordinarily had recourse to purgatives by way of prevention, or which is worse, to ease the pain in the

fit; for when nature is prevented from pursuing her usual, safest, and best method of translating the morbid matter to the joints, and the humours are forced inwards upon the bowels, then, instead of pain in the joints, which is either slight or none at all, the patient is almost destroyed by sickness of stomach, gripings, fainting, and a numerous train of irregular symptoms.

23. For my own part, I am abundantly convinced, from much experience, that purging, either with mild or strong cathartics, of that kind which are given to purge the joints, proves very prejudicial, whether it be used in the fit to lessen the morbid matter, or in its declension to carry off the remainder, or in a perfect intermission or healthy state, to prevent an approaching fit. For I have learnt at my own peril, as well as that of others, that purgatives exhibited at any of these times, have, instead of doing service, hastened the mischief they were intended to prevent. 1. Purging, therefore, during the fit, by disturbing nature when she is separating the gouty matter and throwing it off from the joints, does sometimes eminently disturb the spirits, which renders the fit more violent, and likewise much endangers the life of the patient. 2. Purgatives administered at the end of a fit, instead of expelling the remains of the disease, occasion a fresh fit as severe as the former; and thus the patient being deceived by fruitless hopes, brings those evils upon himself which he had escaped if the humours had not been exasperated afresh. And this inconvenience I myself often experienced, after having had recourse to medicine to expel what I esteem the remains of the distemper. 3. As to purging at certain times in the intervals by way of prevention, though it must be owned that there is not so much danger of occasioning a fresh fit, as in the instance just mentioned, the patient in that case not being perfectly recovered; yet even at this time it is productive of a fit, for the reasons above specified, and though perhaps it may not go off entirely by taking any purge constantly at proper intervals. For I have known some gouty persons, who, to recover their health, not only purged spring and autumn, but monthly, and even weekly, and yet none of them escaped the gout, which afflicted them more severely afterwards, and was

accompanied with more violent symptoms, than if they had totally forbore medicine. For though such purging might carry off a part of the gouty matter, yet as it does not at all contribute to strengthen concoction, but rather weakens it, and injures nature afresh, it only strikes at one cause, and is by no means adequate to the cure of the distemper.

24. To these observations must be added, that the same paucity of spirits, which hurts the concoctions in gouty subjects, renders their spirits weak and languid, so that they are soon disturbed by any cause which considerably hurries either the body or mind, and consequently are very volatile and dissipable, as they frequently are in hysteric and hypochondriac patients. And from this tendency of the spirits to irregular motions, it happens that the gout usually follows the slightest evacuation. For the tone of the parts being destroyed, which the firmness of the spirits, so long as they continue strong, preserves unrelaxed and healthy, the peccant matter moves without interruption; and from this mischief done to the body a fit arises in a short time.

25. But notwithstanding this method is so very pernicious, yet there have been empirics, who have acquired a great character by cunningly concealing the cathartic they use in this case. For it must be noted, that whilst the medicine operates, the patient feels no pain at all, or but a slight one; and if a course of purgatives can be continued for some days, without the intervention of the recent fit, the present fit will soon go off. But the patient will suffer greatly afterwards, by the sudden tumult occasioned by this agitation of the humours.

26. 3. Finally, the carrying off the peccant matter by sweat is manifestly prejudicial, though in a less degree than the above-mentioned evacuations; for though it does not repel the morbid matter to the viscera, but contrariwise propels it into the habit, it is notwithstanding detrimental for these reasons. 1. Because during the interval of the fit it forces the humours, which are yet crude, and fitted for a due separation, upon the limbs; and thus occasions a fit before its time, and in opposition to nature. 2. The promoting sweat in the fit throws and fixes the gouty

matter too powerfully upon the part affected, at the same time occasioning intolerable pain; and if there be a greater quantity thereof than can be received by the part affected, it immediately throws it upon some other parts, and thus raises a violent ebullition of the blood and other juices: and if the body abounds considerably with a serous matter generative of the gout, an apoplexy is hereby endangered.

27. Hence, therefore, it is a very dangerous practice, both in this and other diseases wherein a sweat is raised by art, to evacuate the morbid matter, and it does not flow spontaneously, to force it out too violently, and beyond that degree of concoction, which the humours to be carried off have spontaneously acquired. The excellent aphorism of Hippocrates intimating that concocted, and not crude matters, are to be evacuated, relates to sweating as well as purging; as appears manifestly from that sweat which ordinarily terminates the paroxysms of intermittents; which provided it be moderate, and proportioned to the quantity of febrile matter concocted by the preceding fit, relieves the patient considerably: but if it be promoted beyond the limits prescribed by nature, by keeping the patient constantly in bed, a continued fever thence arises, and instead of extinguishing the former heat, a new one is kindled. So in the gout, the gentle breathing sweats that generally come on spontaneously in the morning after each of the small fits, of which, as I have before observed, the cardinal fit is compounded, eases the pain and restlessness, which tormented the patient so much during the night; but contrariwise, if this gentle moisture, which is naturally of a short duration, be violently forced, and continued longer than the quantity of the morbid matter concocted by the preceding fit requires, the disease is thereby increased. In this, therefore, and all other diseases that I have met with, excepting only the plague, it is nature's province, more than the physician's, to excite sweat, as we cannot possibly learn how much matter is already prepared for such a separation, nor consequently what method is to be taken to promote sweat.

28. Since then it evidently appears from what has been delivered, that it is both a fruitless and a pernicious attempt to



endeavour to cure the gout by evacuating medicines, we are next to inquire what other purpose the curative indications are to be directed to answer. And from a thorough attention to all the symptoms above enumerated we learn, that regard must be had to two causes principally in the cure of this disease. 1. The antecedent, or primary cause, or the indigestion of the humours, proceeding from a defect of the natural heat and spirits: 2. the containing, or immediate cause, of the heat and effervescence of these humours, after the putrefaction and sharpness they have acquired by continuing too long in the body, occasioned by the indigestion above mentioned. Now these causes differ so much from one another, that the medicines which do service in the one, prove pernicious in the other; and hence it is that this disease is so difficult of cure. For at the same time that we endeavour to cure the indigestion by warm medicines, we run the risque on the other hand of increasing the heat of the humours: and contrariwise, whilst we strive to mitigate the heat and acrimony of the humours by a cooling regimen, or medicines, will bring on indigestion, the natural heat being already impaired. But here, by the containing cause, I do not only mean that which is actually deposited in the joints, and forms the present fit, but that also which still lies concealed in the blood, and is not yet prepared for separation. For all the morbid matter is seldom so entirely expelled by the fit, how lasting and severe soever it be, as to leave no remains of it in the body, after the fit is gone off; so that of course regard is to be had to this cause both in the fit, and during the intervals. But as the expulsion of the containing cause is entirely the business of nature, and to be performed according to her own method, and since nothing in the mean time can be done to cool the hot and sharp humours, without injuring the digestive powers, unless it be by avoiding a hot regimen and medicines, which inflame the humours; so doubtless the chief curative intention is, after the digestion is removed, to strengthen the digestive powers, which I shall now treat of, but in such manner, however, that I may in the course of this dissertation, as occasion offers, likewise mention those remedies which tend to mitigate the heat of the humours, and blunt their acrimony.

29. Whatever remedies therefore assist nature to perform her functions duly, either 1. by strengthening the stomach, so that the aliment may be well digested, or 2. the blood, that it may sufficiently assimilate the chyle received into the mass, or 3. the solids, so as to enable them the better to change the juices designed for their nutrition and growth into their proper substance, and 4. lastly, whatever preserves the secretory vessels, and the emunctories in such a state that the excrementitious parts of the whole system may be carried off in due time and order. These, and all medicines of the same kind, contribute towards answering this intention, and are properly entitled digestives, whether they be of the medical or dietetic kind, exercise, or any other of those things, which are called the six non-naturals.

30. Such medicines in general are those which are moderately heating, bitter, or of a mild pungent taste, inasmuch as they agree well with the stomach, purify the blood, and strengthen the other parts. For instance, the roots of angelica and elecampane, and leaves of wormwood, the lesser centaury, germander, ground pine, and the like; to which may be added, such as are commonly called antiscorbutics, as the roots of horse-radish, the leaves of garden scurvy-grass, water-cresses, and the like. But these acrid and pungent herbs, how agreeable and beneficial soever they may be to the stomach, yet as they agitate the morbid matter, which has long been generated, and increase the heat, are to be used more sparingly than those which by their mild heat and bitterness both strengthen the stomach and mend the blood.

31. And in my opinion, a skilful mixture of some kinds of them answers the end of digesting the humours better than any single simple of the same class. For though, whenever we have occasion for the specific virtue of any medicine, it be a true axiom, that the more simple it is, the better it is for the purpose, yet when a cure is intended to be made by answering a particular indication, every ingredient contributes something towards curing the disease; and in this case, the more simples the medicine contains, the more powerfully it will operate. For this reason various forms of medicines may be elegantly compounded of the ingredients above enumerated, and the rest of the like kind.

I give the preference to an electuary made after the manner of Venice treacle, because the fermentation of the simples together improves their virtues and produces a third substance, which possesses greater virtues in the mixture, than any single ingredient in the same quality. But I freely leave the choice of such ingredients, and the form in which they are to be given, to the judicious physician; for I never thought myself obliged to write what they term receipts, but rather to note the true curative indications; the non-observation of which caution has given empirics a handle to cry themselves up for the best physicians, as I have elsewhere observed. However, for the benefit of young physicians, I will communicate the medicine I generally use, which is compounded in the following manner.

Take of the roots of angelica, sweet flag, master wort, elecampane, the leaves of wormwood, the lesser centuary, white hore-hound, germander, ground pine, scordium, common calamint, feverfew, wild saxifrage, St. John's wort, golden rod, thyme, mint, sage, rue, holy thistle, penny royal, southernwood, the flowers of camomile, tansey, lily of the valley, English saffron, the seeds of treacle, mustard, garden scurvy grass, carraway and juniper berries, of each a sufficient quantity. Let the herbs, flowers, and roots be gathered when they are in the utmost perfection, dry them in paper bags till they are reducible into fine powder. To six ounces of each, well mixed together, add enough of clarified honey and canary to make the whole into an electuary, of which let the patient take two drams morning and night.

Or for want of this, let the following be used:

Take of the conserve of garden scurvy grass, an ounce and half; Roman wormwood and orange peel, of each an ounce; candied angelica and nutmeg, of each half an ounce; Venice treacle, three drams; compound powder of wake robin, two drams; and with a sufficient quantity of the syrup of oranges, mix them up into an electuary: let two drams of it be taken twice a day, with five or six spoonfuls of the following distilled water after every dose:

Take of the roots of horse radish sliced, three ounces; garden scurvy grass, twelve handfuls; water cresses, brook lime, sage and mint, of each four handfuls; the peel of six oranges; two nutmegs bruised; Brunswick beer, or mum, twelve pints; draw off only six pints by distillation.

32. Of all the medicines commonly known, Venice treacle is the best for strengthening the digestive faculties; but as it contains many ingredients that over heat, withal a large quantity of opium, an electuary like that above described may be more commodiously composed of the principal warming and strengthening plants. But care must be had to make choice of such simples, as are most agreeable to the patient's palate, because it must be continued a long time, namely, for the most part of his life. Of all simples the Peruvian bark is the best; for a few grains of it taken morning and evening, strengthen and enliven the blood.

33. And in reality, these and such like medicines, which strengthen and enrich the blood (provided their heat be not owing to vinous spirits, for reason hereafter to be given) do most service in this and most other chronic diseases; inasmuch as every disease of this kind is in my opinion to be referred to the same general cause; namely, the indigestion of the humours.

34. But as nothing can put this matter in a clearer light than the giving a view of the difference there is between acute and chronic diseases, it is hoped the reader will not be displeased, if I make a short digression from the present subject. As therefore those diseases are generally deemed acute which soon prove fatal, or are speedily brought to concoction; so these are entitled chronic distempers, which either require a long time to come to concoction, or never come to concoction at all. And this appears manifest, both from the nature of the thing and the terms employed to express it; but the cause of the dissimilitude between those two kinds of diseases being less obvious, and not so easily discoverable, I conceive it will be worth while to spend some time in a research of this nature; since a clear and distinct notion of these particulars may greatly contribute towards discovering the genuine indications suited to the cure of these diseases.

35. Now, whether the inmost bowels of the earth (if the ex-

pression be allowable) undergo various alterations, so as to infect the air by the vapours thence arising, which seems very probable to me; or whether the whole atmosphere be infected by means of an alteration resulting from a peculiar conjunction of any of the planets; certain it is, that the air sometimes abounds with such particles as injure the human body: as at another time it becomes impregnated with such particles as prove pernicious to some species of brutes. During this state of the air, as oft as we receive into the blood by breathing the poisonous corpuscles which are prejudicial to the body, and contract such epidemic diseases, as such tainted air is apt to produce, nature raises a fever, which is the ordinary instrument it employs to free the blood from any noxious matter therein contained. And these diseases, are commonly esteemed epidemic diseases, and are therefore acute and short, because their motion is so quick and violent. But besides these distempers produced by an external cause, there are others not less acute, which proceed from some peculiar inflammation of the blood, and which do not arise from any general cause depending on the air, but from some peculiar irregularity, or indisposition of particular persons. This kind of fevers, which happens in most years, I call intercurrent and sporadic.

36. But chronic diseases are of a very different nature from these; for though a certain and unwholesome air may greatly contribute to their production, yet they do not so immediately proceed from the air, but generally from the indigestion of the humours, the common origin of all these diseases. For when the stamina vitae are much debilitated, and in a manner worn out, either by age, or by remarkable and continued irregularities in the use of the six non-naturals, especially with relation to food and drink; or if the secretory vessels be so far weakened, as to be no longer able to perform their appointed functions of cleansing the blood, and carrying off its superfluities: in all these cases a greater quantity of humours being collected in the body, than can be digested by the strength of nature; these, by their long continuance in the vessels, undergo various fermentations and putrefactions, and at length appear in a species, occasioning

different diseases, according as they are variously vitiated and depraved. And as these vitiated juices differ from one another, so they fall upon the particular part that is best fitted to receive them, and there they gradually manifest those numerous symptoms, which ordinarily proceed, partly from the nature of such juices, and partly from the irregular motion excited in the parts affected; both which causes, in conjunction, constitute that irregularity of nature, which is characterized with the nature of some diseases.

37. Now that most chronic diseases chiefly proceed from such an inability of nature to concoct the humours, will manifestly appear, if we reflect that aged persons, whose digestive faculties are impaired, and their spirits, which are the instruments thereof, are wasted by the repeated functions of a long life, are more subject to these diseases than young persons, whose vital warmth is greater, and dissipates those foul humours which are amassed in the body, and whose secretory vessels are possessed of such a constant natural heat, that they may on no account fail of performing their functions of purifying the blood, unless they are burthened and in a manner obstructed by an overfulness of humours. And farther, that such an indigestion of the humours is the cause of most chronic diseases, is clear from hence, that winter is much more apt to generate them than summer; notwithstanding that some do not actually shew themselves till the decline of winter, though the collection of humours whereon they depend, increases the winter throughout, becoming greater by the coldness of the season, and debilitating nature, so as to render her less able to perform the functions of the animal economy.

38. Hence it is that such as enjoy a good state of health in summer, do notwithstanding rarely escape those diseases in winter, to which they are most subject; as for instance, the gout, asthma, cough, &c. And hence likewise we learn, why travelling into southern countries is so effectual to conquer those diseases, the cure whereof is fruitlessly attempted in a colder climate. The truth of what has been delivered concerning the general cause of chronic diseases, will be farther confirmed by the remarkable and almost incredible relief obtained by riding on

horseback in most chronic diseases, but especially in a consumption. For this kind of exercise strengthens all the digestive powers, whilst it revives the natural heat by a continual motion of the body, and enables the secretory vessels to perform their function of purifying the blood in a proper manner; whence an amendment of the greatly debilitated digestions must needs follow, and, of course, a healthy state.

39. From the reasons therefore just alleged, it sufficiently appears that such warm herbs do great service, where there is no manifest contra-indication, not only in the gout, but in most chronic diseases, inasmuch as they procure a warmth like that of summer, even in the midst of winter: though if we accustom ourselves to use them in summer, they will more effectually prevent such diseases as are ordinarily occasioned by the contrary season. And in reality, if we defer, or neglect taking them till the approach of winter, at which time a considerable quantity of humours is amassed, it is to be apprehended it may then be too late to have recourse to this refuge.

40. But though (as I have already shewn at large) the gout is of so peculiar a nature, as to be rendered worse by cathartics; yet in most other chronic diseases bleeding is to be repeated, as there is occasion; and purging to be ordered before using the strengthening and stomachic remedies here commended; but when the patient has begun with them, they must be continued without any intermediate evacuations; for it is always to be remembered, that whenever the cure of any disease is attempted by means of strengthening remedies, all kinds of evacuation prove highly pernicious. Lastly, I do not assert that the stomachic medicines just enumerated are the most excellent of the kind, but I maintain that whoever happens to discover the most effectual remedy to answer this intention, will be capable of doing much more service in chronic diseases than he can well imagine.

41. But amongst the remarks I proceed to communicate, on the cure of the gout, this is primarily and chiefly to be attended to, namely, that all stomachic or digestive remedies, whether they consist of a course of medicines, a regimen, or exercise,

are not to be entered upon in a heedless manner, but to be persisted in daily with great exactness. For since the cause in this and most other chronic distempers is become habitual, and in a manner changed into a second nature, it cannot reasonably be imagined, that the cure can be accomplished by means of some slight and momentaneous change made in the blood and juices by any kind of medicine, or regimen, but the whole constitution is to be altered, and the body to be in a manner framed anew. For it is otherwise here than in some acute diseases, where a person in full strength and good health is suddenly seized with a fever; whereas in the gout, a person by indulging himself in high feeding, hard drinking, neglecting his usual exercise for several years running, and wearing out his constitution by sloth and idleness, or by hard study, and close thinking, and other errors of life, does at length, in a manner purposely, injure the various ferments of the body, and oppress the animal spirits, which are the principal instruments of digestion, whence the vitiated juices, amassed in the habit, break out as soon as they come to their height, and do much mischief, relaxing the fleshy parts, and weakening the joints, so that they readily receive the humours thrown down upon them. And in this manner a different constitution is formed by degrees, the original natural one being quite destroyed. And those fits which engross the attention of indiscreet and unthinking persons, are no more in effect than the succession and order of symptoms resulting from that method which nature ordinarily employs to expel the morbid matter. Hence, therefore, it is a fruitless labour to attempt the cure of this disease by using any medicine or regimen occasionally: for since this habit is chiefly founded on, and consists in a weakness of all the digestions, and a relaxation of all the parts, both these disorders must be remedied, and the strength of the digestive powers, as well as the tone of the parts, restored and recovered by degrees to the former healthy state of the body. But though it may seem impossible to compass this end effectually, not only because any particular habit cannot easily be changed into a contrary one, but also, because old age, which ordinarily accompanies this disease, greatly obstructs this design; yet the



cure is to be attempted as far as the strength and age of the patient will permit, who will have the gout more or less severely the farther he declines from, or the nearer he approaches this state.

42. Farthermore it is to be observed, that digestive remedies, either of the medicinal, or dietetic kind, are to be used chiefly in the intervals of the gout, and at as great a distance as may be from the subsequent fit. For age obstructs the cure so much, that the strengthening the digestive powers, the recovering the debilitated ferments of the body, and restoring the blood and viscera to their due healthy state, cannot be speedily accomplished, and requires a continued use of medicine.

43. But though these and the like remedies may do service, yet they are not able alone to answer this intention of strengthening, but need the joint assistance of such things as do not properly belong to medicine; it being an error to imagine that this, or any other chronic disease, can be cured by medicine only.

1. Therefore moderation in eating and drinking is to be observed, so as on the one hand to avoid taking in more aliment than the stomach can conveniently digest, and of course increasing the disease thereby, and on the other hand defrauding the parts, by immoderate abstinence, of the degree of nourishment requisite to keep up the strength, which will weaken them still more; either of these extremes being equally prejudicial, as I have often experienced both in myself and others.

2. As to the quality of the food, though whatever is easy of digestion, singly considered, deserves the preference, yet regard must be had to the palate and appetite, because it is frequently found that what the stomach earnestly covets, though of difficult digestion, does nevertheless, digest better, than what is esteemed of easier digestion, if the stomach nauseates it; but for this reason indigestible aliment should be used more sparingly.

3. I am of the opinion that the patient ought to eat only of one dish at a meal, because feeding on different sorts of flesh injures the stomach more than eating an equal quantity of any one kind; but excepting flesh he may eat other things at pleasure, provided they be not sour, salt, or spiced: because, though such food does not hurt digestion, it

nevertheless does mischief by putting the morbid matter in motion.

44. As to the times of eating, only dining is necessary; for as the night should seem peculiarly designed to digest the humours, it would be wrong to waste that time in digesting the aliment. For this reason gouty persons should forbear suppers, but they may drink a large draught of small beer, as being generally subject to the stone in the kidneys; the growth whereof is considerably obstructed by drinking such a liquor at this time, as it cools and cleanses the kidneys.

45. A milk diet, or the drinking milk, either as it comes from the cow, or boiled, without adding any thing to it, except perhaps a piece of bread once a day, hath been much used these twenty years past, and hath done more service in abundance of gouty subjects, whilst they persist in it exactly, than all other kinds of remedies. But upon quitting it, and returning to the ordinary way of living of healthy persons, though they used the mildest and slenderest diet, the gout immediately returned with more violence than ever; for as this regimen weakens the constitution, the patient cannot so well struggle with the distemper, whence of course it proves more dangerous and lasting. Whoever, therefore, intends to pursue this regimen, ought beforehand to consider maturely, whether he be able to persevere in it for life, which perhaps he will find too much for him, though he should be a person of great resolution. For I knew a nobleman, who, after living a whole year on milk only with much pleasure, during which time he had one or more motions every day, was constrained to leave it off, because he grew costive on a sudden, the temper of his body altered, and his stomach at length nauseated milk, though he had still a liking to it. Again, it is observable that some hypochondriac persons of a gross habit of body, or those who have been long used to drink spirituous liquors freely, cannot bear milk. And farther, the short and fleeting benefit which those who can bear milk receive from this regimen, is not only derivable from its exceeding simplicity, whence I doubt not but water gruel may have the same effect, provided the stomach will bear it, but from its rendering the blood softer and

smoother, by blunting the sharp particles contained in the mass; and moreover, which I esteem the principal thing, milk being an aliment that is absolutely unfit for grown persons, represses the turgescence or plenitude of the humours which occasions the gout; and for this reason the few with whom it agrees escape this disease so long as they live upon milk only, but no longer. For as it runs directly counter to the original cause of the gout, which is the debility of the digestions and ferments, it does much more mischief in this respect than benefit in the other. And for want of attending sufficiently to this particular, some inconsiderate persons have fallen into gross and manifestly fatal errors; having, by attempting to conquer the containing cause of the disease, namely, the heat and acrimony of the humours, destroyed the digestions, and all the natural functions.

46. As to liquors, those are best, in my opinion, which are weaker than wine, and not so weak as water; such as our London small beer hopped, or unhopped, extremes on either hand being pernicious. For, 1. as to wine, though the common proverb intimates that whether a person does, or does not drink wine, he will have the gout; yet it is certain, and confirmed by the experience of abundance of gouty patients, that wine is in fact detrimental. For though it may be supposed to do service by strengthening the digestive powers, the weakness whereof I have looked upon as the antecedent or primary cause of the gout; yet, with respect to the containing cause thereof, it must be deemed wholly pernicious, because it inflames and agitates the humours which feed the disease. Neither do we grant that wine used by way of common drink helps digestion, but rather assert, that it destroys it, unless in such as have drank it for a long time. For though wine may, in passing through the vessels, communicate some heat to the parts, yet it certainly depraves the ferments of the body, and wastes the natural spirits: and hence I conceive it is that great drinkers generally die of the gout, palsy, dropsy, and other cold diseases. Furthermore, the continued and immoderate uses of wine relaxes and enervates the body, rendering it like the bodies of women, whereas moderately heating liquors strengthen the tone of the parts; whence

such as have always drank small liquors are rarely afflicted with the gout. It must farther be noted, that those are chiefly subject to this disease, who, though they have naturally a weak digestion, do, notwithstanding, receive too much nourishment from a certain richness of the blood, and grow more bulky by a kind of indigested matter, instead of a solid wholesome substance. And the use of wine adds to this richness of the blood, and so not only amasses a new collection of matter, but also actually occasions the disease, by stirring up the cause of it, which had long lain concealed and inactive. Again, as the blood of gouty subjects nearly resembles that which is taken away in a pleurisy, and other inflammatory diseases, it is absurd to inflame it more with spirituous liquors. And it is as dangerous, on the contrary, to have recourse to over-cooling liquors; which, by utterly destroying both the digestion and natural heat, do more mischief, not occasioning pain, as wine doth, but death itself: as experience shews in those persons who have used themselves to drink wine freely from their youth upwards to old age, and quitted it of a sudden for water or small liquors, have soon destroyed themselves thereby.

47. Gouty persons should therefore make it a rule in this particular, to drink such liquors as will not inebriate, if drank in a large quantity, or injure the stomach by their chilness. Of this kind, as I before hinted, is our small beer; and in other countries a similar liquor may be made by diluting wine well with water. As to water alone, I esteem it crude and pernicious, and have found it so to my cost; but young persons may drink it with safety, and it is at this day the common drink of the greatest part of mankind, who are happier in their poverty than we are with our luxury and abundance. This is confirmed by the great multitude of diseases with which we are afflicted upon this account, as the stone, gout, apoplexy, palsy, &c. besides the injury done to the mind, in being drove from its natural rectitude, by the disturbance which the fiery spirits of such liquors, together with the animal spirits which assist the thinking powers, occasion by volatilizing the mind too much, and suggesting vain and idle notions, instead of solid and weighty reasonings, and thus at

length rendering us drolls and buffoons instead of wise men; between which the difference is almost as great as between a substance and a shadow.—But enough of this.

48. But though a person, who has the gout mildly and only at intervals, need only use small beer, or wine diluted with water, this degree of the disease not requiring a stricter regimen; yet when the whole substance of the body is in a manner degenerated into the gout, it cannot be conquered without a total abstinence from all kinds of fermented liquors, how small and smooth soever they be; inasmuch as all liquors of this kind contain a pungent spirit, with some degree of acrimony; and, what is worse, being possessed of a ferment, they dispose the humours to a perpetual fermentation, in the same manner as yeast added to malt liquors communicates its fermenting quality to the whole liquor. For this reason a diet drink is to be ordered for common drink, to be made of those ingredients which are usually known and applied to this purpose; but it must not be too strong, because in that case it will inflame the humours as much as wine; neither, on the contrary, must it be so small as to injure the natural functions by over-cooling. And this kind of drink, provided it be made of such ingredients as the patient most likes, though it may occasion some loathing for the first week or fortnight, does nevertheless prove as agreeable afterwards, as any other liquors he has been used to drink. It will likewise quicken the appetite, and render it more natural than it used to be with fermented liquors; and will be attended with this farther convenience, that whoever uses it for his common drink, may indulge more freely in other kinds of diet, than when he drank wine or beer: for the errors in point of diet, which it is hardly possible to avoid entirely, will be in some measure corrected and amended thereby. But the principal benefit derivable from it, is being preventive of the stone, which is the general attendant of the gout; as all sharp and attenuating liquors both contribute to breed the stone, and occasion a fit thereof. I prefer the following decoction for its agreeable colour and taste:

Take of sarsaparilla, six ounces; sassafras wood, China root, and the shavings of hartshorn, each two ounces; liquorice

root, an ounce; boil them together in two gallons of spring water for half an hour; afterwards infuse them upon hot ashes close covered for twelve hours; then boil them till a third part of the liquor is exhaled; and as soon as it be taken off the fire, infuse therein half an ounce of aniseeds for two hours; lastly, strain it off, and let it rest, till it becomes clear, and put it into bottles for use.

49. It is properest to begin with this decoction immediately after the fit of the gout is gone off, and it must be continued, both in the fit and intervals, during the remainder of life. For it is not sufficient at a time when the disease actually rages to study for new medicines, as nature, whilst the humours are in such commotion and disturbance, cannot well bear the exchange of fermented liquors, of an active and spirituous quality, for such as are small and without spirit. At the same time the above-mentioned electuary must be taken every day, both in the fit and in the intervals; for the warmth of this will in some measure correct the smallness of the diet drink, as it will communicate a due degree of heat to the blood and viscera, without the agitation which is generally occasioned by the heat of fermented liquors.

50. If it be objected that a total abstinence from wine and other fermented liquors would render life in a manner insupportable, I answer, it must be considered, whether it be not much worse to be tortured daily by the pain accompanying an inveterate gout (for when it is gentle there is no need of so strict a regimen) than to be confined to this decoction; which, if he continues, he may indulge himself in most other kinds of aliments; not to repeat now that this drink, like all other things, grows pleasant by custom. Doubtless, whoever hath had this disease, if he is not void of reason, will not hesitate at all to which to give the preference.

51. But notwithstanding, if the patient, either 1. from a long continued and immoderate use of intoxicating liquors; 2. or by reason of old age; or 3. great weakness, cannot digest his food without wine, or some other fermented liquor, it is certainly dangerous for him to leave off wine on a sudden; an error that

has in reality destroyed abundance of people. Such a person, therefore, in my opinion, should either not use the dietetic apozem above prescribed; or, if he be resolved to take it, should accustom himself to it by degrees (drinking a glass of wine for some time at meals) and rather by way of medicine than diet, till it becomes more familiar to him. But Spanish wine is to be preferred here to Rhenish or French wine; these last being apt to exasperate the humours, and increase the morbid matter, notwithstanding they are very grateful to the stomach. To which we may add, that as they are almost as crude and indigested as our cyder, they are consequently not so warm and cordial as the case demands. And these particulars shall suffice concerning the diet of gouty persons.

52. There is another caution to be inculcated, which though it may seem trifling, is of great moment, both in order to digest the gouty matter during the fit, and also to prevent the generation thereof in the intervals; and that is, going to bed early, especially in winter. For, next to bleeding and purging, nothing impairs the strength more than sitting up late a-nights; which every valetudinarian can affirm from his own experience, provided he has only carefully observed how much more vigours and cheerful he rose in the morning when he went to bed early, and how languid and faint he has found himself after sitting up late. And though there may seem to be no difference betwixt going to bed earlier or later, provided a person lies in bed the same number of hours; as, for instance, whether he goes to bed at nine and rises at five, or at eleven and rises at seven; yet it is not so, and, I conceive, for this reason principally, namely, that in the day the spirits are dissipated, either by exercises of the body or mind, which are so weak, in sickly persons, that they require the assistance of sleep earlier in the evening; and as the approach of night occasions a kind of relaxation of the animal economy, the tone of which was kept up in the day by the heat of the sun, the warmth of the bed becomes necessary to supply the place of the sun, especially in the winter season. But the spirits being refreshed and invigorated in the morning by the preceding night's sleep, together with the warmth of the bed, and the ensuing

day likewise strengthening the tone of the parts still more, the rising early at this time, though it may take an hour or two from the morning sleep, hurts the constitution less than sitting up an hour or two later in the evening. For this reason I would advise such as are subject to the gout to go early to bed, especially in the winter, and to rise betimes in the morning; though their having less sleep than usual may incline them to lie longer, in order to get it up. For the sleep which is got in the morning will rob them of as much the next night; and thus at length by doing violence to nature, and despising its wise dictates, the night may be preposterously turned into day, and the day into night.

53. The patient must likewise use his utmost endeavour to keep his mind easy, for all disquieting passions, if they once become immoderate, greatly dissolve the texture of the spirits, which are the instruments of digestion, and so of course increase the gout. He should, therefore, wisely reflect on his mortality, and not vainly imagine he is to escape the evils that are necessarily annexed to this state; for, whether any affliction of mind befalls him through his own fault, or that of others, certain it is that he will never be able to prescribe laws to the world, which has not always obeyed any single person hitherto, how powerful and wise soever he hath been; nor will every thing always answer any body's expectation so exactly, as he vainly hoped they would, but whilst he is engaged in regulating his affairs, of a sudden he becomes an example of human frailty, and unreasonably deprives himself of the transitory enjoyments of life. Too much application to study and business is likewise equally pernicious; for as this disease is oftener accompanied with melancholy than any other, such as are subject to it ordinarily fatigue and oppress the spirits to that degree, by long and intense thought, without the artificial help of reading, so that the body cannot longer preserve itself in a healthy state: and hence I conceive it is, that few fools have had the gout.

54. But nothing so effectually prevents the indigestion of the humours, (which I esteem the principal cause of the gout) and consequently strengthens the fluids and solids, as exercise. It



must, however, be observed, as I have already mentioned, that as there is more necessity for making a thorough change in the constitution in this than in any other chronic disease, so exercise, unless it be used daily, will do no service; for if it be intermitted at times, it will avail little towards changing the constitution, now reduced to a languishing and tender condition by idleness and indulgence, and may perhaps do mischief by causing a fit, after leaving it off for a considerable space of time. But exercise should be moderate, because the contrary in aged persons, who are chiefly subject to the gout, wastes the spirits too much, and consequently hurts the concoctive powers which are strengthened by continued and gentle exercise. And though a person may think this hard, who, besides old age, inability to motion, and indolence, which is in a manner natural in this disease, is likewise tormented with pain, yet if exercise be omitted, all the remedies which have hitherto been discovered will not at all avail. And as the intervals between the fits cannot be long, without constant exercise, so the patient will likewise be more subject to the stone, which is a more dangerous and painful disease than the gout.

55. To these we subjoin another momentous particular, namely, that the chalky concretions are considerably increased in the joints, and especially in the fingers, by long inaction; so that at length these parts quite lose their motion. For however positively some may assert, that the matter of these concretions is only the tartar of the blood translated to the joints, it will nevertheless easily appear, upon considering the thing with a little more attention, that when a large quantity of indigested gouty matter falls upon some of the joints, and occasions a lasting swelling of the neighbouring parts, it happens at length, partly from their assimilating property being destroyed, and partly from the obstruction caused therein by this sluggish humour, that this matter is generated, which is changed into this kind of substance by the heat and pain of the joint, and increases every day, converting the skin and flesh of the joint into its own nature, and may be picked out with a needle, and resembles chalk, crab's eyes, or some similar substance. But

I have experienced, in my own particular, that not only the generation of these concretions may be prevented by daily and long continued exercise, which duly distributes the gouty humours throughout the whole body, that otherwise readily attacks a particular part, but it also dissolves old and indurated concretions, provided they be not come to such a degree as to change the external skin into their substance.

56. As to the kind of exercise, riding on horseback is certainly the best, provided it be not contra-indicated by age, or the stone; and indeed I have often thought, if a person was possessed of as effectual a remedy as exercise is in this and most chronic diseases, and had the art likewise of concealing it, he might easily raise a considerable fortune. But if riding on horseback cannot be used, frequent riding in a coach answers almost as well; and in this respect, at least, the generality of gouty persons have no cause to complain, because their riches, which induce them to live in such a luxurious way as occasions the disease, enable them to keep a coach, in which they may take the air, when they cannot ride on horseback. It must be noted, however, that a healthy air is vastly preferable to an unhealthy one for this purpose; thus the country is better than the town, where the air is full of vapours that exhale from the shops of different mechanics, and rendered still denser by the closeness of the buildings, as it is in London, which is esteemed the largest city in the universe. But the great difference there is between using exercise in the country, or in town, a gouty person will soon find upon trial.

57. With respect to venery, if the gouty patient be in years, and so destitute of a sufficient share of spirits to promote the digestions, and his joints and the neighbouring parts consequently too much debilitated and relaxed, without any assistant from this destructive quarter; in this case, I say, it is as imprudent for such a one, in my opinion, to indulge those pleasures, as it would be for a person, after having engaged to go a long journey, to spend all his stock of provisions before setting out. Moreover, besides the mischief he does himself for want of restraining the languid inclinations of declining age, he loses the great privilege

of enjoying that exquisite satisfaction, which by the particular indulgence of nature is reserved for the aged only, who, towards the period of their lives, are freed from the violence of those passions, which like so many savage beasts, preyed upon them perpetually in youth, the gratification of them being by no means an equivalent for the long train of evils, which either accompany, or follow it.—And let this suffice for the regimen.

58. But though a gouty person by carefully observing these rules relating to diet, and the rest of the non-naturals, may prevent violent fits, and so strengthen the blood and solid parts, as to free himself from that multitude of evils, which renders the disease not only intolerable, but in the end fatal; yet, notwithstanding, after some intervals, he will sometimes be seized with the gout, especially towards the close of winter. For though in the summer season, whilst the tone and strength of the blood are increased and preserved in that state by the heat of the sun, and perspiration goes on in a proper manner, the digestions must needs be much better performed than in winter; yet, as the blood is weakened and perspiration obstructed upon the approach of this season, there must needs be a copious indigested matter amassed, which at length, by its long continuance in the habit, will form a species, manifesting itself by proper symptoms, and giving a fit upon the first occasion, either by the humours being put into motion by the nearer approach of the sun, the use of wine, violent exercise, or any other apparent cause.

59. It is clear from what has been delivered, that whoever undertakes the cure of this disease, must endeavour to make a thorough change of his habit of body, and restore it to its former constitution, as far as age and other circumstances will permit; and this must be attempted only in the intervals between the fits. For when the morbid matter is not only generated, but already thrown upon the joints, it will be too late to endeavour to change it or to expel it any other way; since it must be expelled by that method only which nature points out, and the business is to be left entirely to her management. This practice obtains in the paroxysms of intermittents; which, for the same reason, we do not attempt to remove till the heat be over: for

it is equally absurd to be solicitous to take off the heat, thirst, restlessness, and other symptoms of these fevers, as to think the gout is to be cured by endeavouring only to abate the symptoms; whereas the cure is by this means obstructed and prolonged; for the more the pain is eased, the more the concoctions of the humours are prevented; and in the same degree the lameness is relieved, and the expulsion of the morbid matter is checked. Again, the more the violence of the fit is suppressed, the longer it will last, and the shorter likewise the interval will be between the fits, and less free from every degree of the symptoms accompanying this disease; which will be acknowledged by any person, who has attentively considered what we have delivered above in our history of this disease.

60. But though nothing considerable must be attempted in the fit, excepting only that those symptoms are to be relieved which an improper method of cure sometimes occasions; yet, as this disease is unanimously held to arise from a plenitude of humours, it may not perhaps be amiss for the patient to forbear flesh for a few days in the beginning of the fit, and instead of it to use water-gruel, or some similar aliment; for such a slender diet will greatly contribute towards lessening the quantity of the morbid matter, and give nature an opportunity of digesting it sooner. But as constitutions differ considerably, insomuch that some persons cannot bear to abstain from flesh without being immediately seized with a disturbance of the spirits, faintings, and other symptoms of the hysteric kind; such therefore will receive hurt by refraining from flesh any longer than the stomach is set against it, which for the most part is only the first or second day of those particular fits, all which joined together constitute the whole fit, as we have intimated above. But whether the patient eats flesh sooner, or later, he must be very cautious both of eating more during the fit than is requisite to support nature, and of the quality of the food. For great care should be had to guard against every error, either in the quantity or quality of the diet, both solids or liquids, even in the intervals of the fit, and especially in the fit itself. And farther, no little regard is to be had in the intervals to the rest of the non-naturals,

of which we have discoursed largely above; and though the pain and great inability to motion may seem to contra-indicate exercise, which I have chiefly extolled in this distemper, the labour must nevertheless be undertaken; for though the patient may think himself utterly unable to bear to be carried into a coach in the beginning of the fit, and much more so to endure the motion of it, yet upon trial, he will soon find himself more easy from such a motion, than he is at home in his chair. Again, if this kind of exercise be used morning and afternoon for some hours, another advantage attends it, namely, it causes him to rest a great part of the nights, which he could not do when he kept constantly within doors; for very moderate exercise fatigues a gouty person so much, that he falls asleep; besides, this kind of exercise is in some degree preventive of the stone, which an idle and sedentary life generally occasions. But the principal advantage resulting from the constant use of exercise is, the preventing the loss of motion in the limbs, which seizes several persons after the first or second long fit, occasioned by the contraction of the tendons of the hams and heels; for when the pain has been so violent that they have lain still a long time, not caring to stretch out their legs when it has attacked the knees, they at length lose the use of their legs and feet for the remainder of life, both during the intervals, and in the fits, which nevertheless they do not escape. Again, in aged persons, whose concoctions are considerably vitiated, and who by their long continuance of the disease, have the substance of their bodies in a manner changed into the gout, it is not to be expected that the disease can ever be brought to digestion without exercise; for when it exceeds the natural strength, they frequently perish by fainting and sickness, occasioned by the copious morbid indigestible matter, which cannot be assimilated, and destroys them like poison.

61. But notwithstanding that has been said of the usefulness of exercise in the paroxysms of the gout, yet, if the fit be so violent as to sink the patient in the beginning of it (which happens chiefly in those subjects in whom the gout is at the height and hath continued in that state for many years) and confine him

to his room, it will likewise be proper for him to keep his bed a few days, till the pain abates, and the warmth thereof will in some measure supply the want of exercise; for lying constantly in bed digests the morbid matter more effectually in a few days, than sitting up does in many, especially in the infancy of the disease, provided that the patient can forbear flesh without faintings, and other bad symptoms, and be contented only with water-gruel, small beer, and the like. But it is well worth noting, that if the gout be inveterate and disposed the patient to faintings, gripings, a looseness, and the like symptoms, that he is in great danger of being destroyed by one of these fits, unless he uses exercise in the open air: for abundance of gouty persons have been carried off by those symptoms which they have been subject to, from being confined within doors, and especially in bed, who had lived longer if they would have borne the fatigue of riding in a coach most part of the day. For, though a person who is afflicted only with a pain of the limbs, may keep his room; yet another who, instead of violent pain, is troubled with sickness, and the other symptoms above enumerated, cannot do the same without endangering his life. And, in effect, it is well for the patient that there is no great need of motion, or exercise, as long as the pain continues so severe, that he cannot bear it; his life being secured by the pain, which is the sharpest remedy in nature.

62. But as to the symptoms of the gout; we are to relieve those which threaten life, the most frequent of which are the weakness and faintness of the stomach, with gripings, as if occasioned by wind; and these happen either to those who have had the gout many years; or to those who, though they have not had it long, have nevertheless brought it on too hastily by quitting spirituous liquors, of a sudden, for thin and very cooling liquors, or by applying repelling plaisters and other cooling topics, to the parts affected, to ease the pain; whence the morbid matter, which should have been deposited in the joints, is translated to the viscera. I have tried several remedies in my fits of late years to relieve those symptoms; but nothing did me so much service as a small draught of canary, taken occasionally as the

sickness and faintness required. Neither French claret, Venice treacle, or any other of the cardiacs I am hitherto acquainted with, is so efficacious. But we are not to imagine that canary or any other cordial can wholly secure the patient without the use of exercise.

63. But if some violent symptoms come on suddenly, from the striking in of the gouty matter, and threaten death, we are not to trust to the wine, or exercise above commended; but here, provided only the natural, or vital parts, and not the head, be affected, we must have immediate recourse to laudanum, and give twenty drops of it in a small draught of plague water, and the patient must compose himself to rest in bed.

64. But if the gouty matter occasions a looseness, for want of being translated to the limbs, provided it be not the crisis of a particular fit, and yields not to laudanum and exercise of all kinds (for this is to be tried first in the cure of a looseness) but continues, attended with sickness, gripings, and the like symptoms; the only remedy I know in this case, is to raise a sweat by a suitable method and medicines; and if this be done every morning and night for two or three days running, keeping it up two or three hours at a time, it generally checks the looseness, and forces the morbid matter to the limbs. To this method I owe my recovery from this disease some years since (which I had imprudently occasioned by drinking cold water for my common drink) after having used cardiacs and astringents of various kinds to no purpose.

65. There is another symptom, which I have often seen, though it is not so common, namely, a translation of the peccant matter to the lungs, by a cough in the winter season, occasioned by taking cold in the fit, which by degrees invites the matter to those parts, the joints the meanwhile being in great part, or totally freed from the pain and swelling, from the translation of the morbid matter to another part. In this single case, the curative indication is not to be levelled at the gout, but this symptom is to be treated like a true peripneumony; namely, by repeated bleeding, and cooling and incrassating medicines and diet, as the blood that is taken away, especially in this symptom,

exactly resembles that of pleuritic persons. The patient likewise should be gently purged in the intervals of bleeding, to carry off the matter that is lodged in the lungs. But sweating, how effectual soever it may be in forcing the morbid matter upon the limbs, proves detrimental in this case, by hardening the matter that is driven upon the lungs; whence proceed small abscesses, and in the end certain death.

66. It is farther to be noted, that most gouty persons, after the disease has been of long standing, become subject to the stone in the kidneys, and are generally seized with nephritic pains, either at the height, or more frequently at the declension of the cardinal fits, which are very severe, and weaken the patient considerably, who was but too much debilitated and exhausted by the proceeding distemper; in this case, omitting all other remedies, let him immediately drink a gallon of posset drink, in which two ounces of marshmallow roots have been boiled, and inject the following glyster:

Take of the roots of marshmallows and white lilies, of each an ounce; the leaves of mallows, pellitory of the wall, bears-breech, and camomile flowers, of each one handful; linseed and fenugreek seed, of each half an ounce; boil them together in a sufficient quantity of water to a pint and half; dissolve in the strained liquor brown sugar and syrup of marshmallows, of each two ounces: mix the whole for a glyster.

As soon as the posset drink is vomited up, and the glyster come away, exhibit twenty-five drops of liquid laudanum, or fifteen grains of Matthew's pills.

67. If outward application be inquired after to ease the pain of the gout, I know of none (though I have tried abundance, both in myself and others) besides coolers and repellents, which I have already shewn to be unsafe. And I scruple not to affirm from a long course of experience, that most of those who are supposed to perish by the gout, are rather destroyed by wrong management, than by the disease itself. But if a person be desirous of trying the efficacy of such external medicines as are esteemed certain anodynes, to prevent being mistaken, instead of



applying them at the declension of a particular fit, when the pain is just going off spontaneously, let them be used in the beginning, and he will soon be convinced of their insignificancy and the groundlessness of his expectations, as they sometimes do mischief, but can never do service. For this reason I have laid aside the use of topics for several years; but I found most benefit formerly from a cataplasm, made of white bread and saffron boiled in milk, with the addition afterwards of a small quantity of oil of roses; which, however, did not relieve me in the beginning of the fit. If, therefore, the pain be extremely severe the patient had better keep in bed till it abates a little, than to have recourse to anodynes; but notwithstanding it will be proper, if the pain be violent, to take a dose of laudanum in the evening, otherwise it were better omitted.

68. But now I am treating of outward applications, I must say something of a certain Indian moss, entitled moxa, which is highly esteemed of late in the cure of the gout, the manner of it being to burn slightly the part affected with it. Now, though this remedy is said to come from the East Indies, and to have been unknown to the Europeans till of late years, it will nevertheless appear to be of more ancient date with us, by consulting the writings of Hippocrates, compiled above two thousand years since. For treating of the Sciatica, he advises, "If the pain be fixt in any one part, and does not yield to medicines, in whatever part it be, to burn it with raw flax"; and a little farther, speaking of the gout in the feet, he says, "The same things are proper here, that do service in the gout of the joints; and indeed this is a long and painful, but not a mortal disease: if the pain however continue in the fingers, burn the veins above the joints with raw flax." Now I imagine that nobody can think there is such a specific difference between the flame of burning flax, and that of India moss, as to render the latter more effectual in the cure of the gout than the former; any more than he can suppose that a fire made with oak billets can do more than another made of ash. This burning the part affected bids fair to ease the pain, and may sometimes effect it; the most subtle and spirituous part

of the morbid matter deposited in the part being by this means expelled. But the relief hereby obtained must needs be short, because it does not reach the indigestion, which is the antecedent cause of the gout; and it may seem needless to observe, that it is to be used only in the beginning of this disease. For when the gout, either by reason of its long continuance, or from wrong management, retreats to the internal parts, which sometimes happens, and, instead of pain, causes sickness, gripings, and abundance of the like symptoms, no judicious person will be for using fire.

69. And now I have communicated all that I have hitherto discovered concerning the cure of this disease; but if it be objected, that there are many specific remedies for the gout, I freely own I know none, and fear that those who boast of such medicines are no wiser than I am. And, in effect, it is to be regretted, that the excellent art of medicine should be so much disgraced by such trifles, with which the credulous are deceived, either through the ignorance or knavery of authors; remedies of this kind being extravagantly extolled in most diseases by such as make a trade of those trifles. But what is more surprising, this ridiculous fondness does not only obtain in such diseases as are regularly formed, and proceed from some injury of the organs, or from an external cause, and it imposes upon persons that in all other respects are men of judgment. We have sufficient proof of this in such medicines as are commonly deemed specifics in contusions; such as spermaceti, Irish slate, &c. which only mislead us from the method required in these cases, as will appear by trying how much more safely and expeditiously these accidents may be cured by bleeding and purging alternately, without having recourse to these insignificant remedies, which are generally given after the first bleeding, and likewise to the raising of a sweat, which ordinarily continues during the use of them, and heats the parts already disposed to an inflammation, so as to endanger the life of the patient without necessity.

70. To conclude: The method I have here laid down is founded

upon a search into the above-mentioned signs and symptoms of the distemper, and by pursuing it I have relieved myself and others; but the radical cure of the gout is yet a secret, nor do I know when, or by whom it will be discovered. I hope, nevertheless, that I have contributed in some degree to the good of mankind by this treatise, by faithfully pointing out those rocks whereon myself and many others have split, subjoining likewise the best method of cure which I have hitherto discovered, which is all I promise, though after long consideration I cannot help thinking that such a remedy will be found out hereafter; and if ever this should happen it will betray the ignorance of the theorists, and clearly shew how notoriously they are mistaken in the knowledge of the causes of diseases, and in the medicines they give to cure them. We have a plain proof of this in the Peruvian bark, the best specific in intermittents: for how many ages had the most acute physicians spent in searching into the causes of intermittents, and adapted such methods of cure as were best suited to their several theories! But how little honour those methods did to the theories whereon they were founded, appears from a late instance in practice of those, who, ascribing the various kinds of intermittents to the redundancy of different humours in the body, ordinarily attempt the cure by altering the evacuating those humours; which succeeded ill with them, as is manifest from their failure, but especially from the more successful use of the bark, by the help of which, if given in a proper manner, we commonly answer the end effectually, without regarding those humours, diet, or regimen; unless the patient be unnecessarily kept in bed whilst he is taking it; in which case, however, so efficacious is this medicine, that it seldom fails curing the patient, notwithstanding this inconvenience of increasing the disease by the warmth of the bed. In the mean time, till the radical cure of the gout be found out, which all physicians, and myself in particular, ought to wish for, I entreat the reader to receive this little treatise in a favourable manner; but if he should not, I am so well acquainted with the tempers of mankind, that it will be no great disappointment to me; and I know my

duty so well, that I shall not be discouraged thereat. And if the racking pains, unfitness of motion, and other disorders which I have been afflicted with during the greatest part of my life, together with the loss I have sustained in my business by sickness, may be a means of relieving others, I shall have some reward for the miseries of this kind which I have suffered in this life, now I am leaving it for another.

THE END.



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*Compiled by*

EMERSON CROSBY KELLY, M.D., F.A.C.S.

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## John Hunter

### BIOGRAPHY

- 1728 Born February 14th, at his father's estate, Long Calderwood, in the parish of Kilbride, Lanarkshire, about eight miles from Glasgow, the youngest of a family of ten. Disliked school, hated studies and lived as much as possible in the open fields where he studied nature, especially birds and insects.
- 1745 Age 17. Apprenticed for a time to a relative, a cabinet-maker, but seems to have been quite incorrigible.
- 1748 Age 20. As a last resort to make something of him, he was sent to live with his elder brother, Dr. William Hunter, who was conducting a successful anatomy school in London. John took a deep interest in dissection and the preparation of anatomical specimens for his brother William.
- 1753 Age 25. Became a surgical pupil of William Cheselden at Chelsea Hospital, then of Percival Pott at St. Bartholomew's. He continued assisting his brother in dissection and traced the descent of the testes in foetus and made discoveries as to the nature of the placental circulation.
- 1754 Age 26. Entered as a Gentlemen Commoner at St. Mary's Hall, Oxford, where he remained only a few weeks, being unwilling to "stuff Latin and Greek." He returned to London and was house surgeon at St. George's for about five months.
- 1759 Age 31. Being a physically delicate man, he developed

symptoms of lung trouble. His association with his brother William was dissolved.

- 1761 Age 33. Received an appointment with his Majesty's forces in the Seven Years War against the French. Sailed from England as a surgeon with the expedition to Belle-Isle off the coast of Brittany in the Bay of Biscay.
- 1762 Age 34. Ordered with the troops to Portugal where he continued his first-hand observations on the anatomy and physiology of all types of sea and animal life which came into his possession. He became adept at military surgery and began his studies of coagulation of the blood. During this period he started his famous collection of natural history subjects which now makes up the Hunterian Museum.
- 1763 Age 35. Return to London engaged to Anne Home, daughter of one of his superior officers. While building a surgical practice he taught anatomy in Golden Square adjoining Regent Street. Later he built a home on Earl's Court which became a veritable museum of living and dead specimens of animal and piscinal life.
- 1767 Age 39. Elected a Fellow of the Royal Society of London and became a member of the Corporation of Surgeons.
- 1768 Age 40. Elected Surgeon to St. George's Hospital, a position which he held until his death twenty-five years later.
- 1771 Age 43. Married Anne Home. He continued to collect specimens and obtained the carcasses of animals dying at the menagerie then attached to the Tower of London. It is related that he once gave five pounds for a dying tiger and had to borrow the money from a book-dealer friend. He expended a large amount on his collection. He became such a popular teacher that he was able to charge what was, in those days, the large sum of five hundred guineas for the privilege of apprenticeship to himself. One of these pupils has become as widely known as the teacher; namely, Edward Jenner.

1793 Age 65. Suffered with increasing frequency from spasmodic attacks of angina pectoris. He stated "My life is in the hands of any rascal who chooses to annoy and tease me." At a board meeting of St. George's Hospital on October 16th, 1793, he became angry, suffered an attack of angina and died in a few moments. He was first buried in St. Martin's-in-the-Fields from whence on March 28th, 1859 his remains were transferred to Westminster Abbey.

John Hunter was in the habit of rising at four or five in the morning after sleeping about four hours. These early hours were spent in his museum. Breakfast was served about nine. Towards eleven he proceeded in his carriage to his calls and consultations. The forepart of the afternoon was spent at St. George's Hospital but dinner was always ready punctually at four. A short nap of one hour followed this repast, whether there were guests or none. Then save for incidental interruptions the evenings were occupied with his self-imposed tasks either in town or at Earl's Court. (Schlueter).

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## INTRODUCTION

John Hunter is considered to be one of the greatest surgeons of all time, ranking with Ambroise Paré and Joseph Lister in his contributions to medicine. But unless we examine the whole sum and substance of Hunter's work, it is difficult to see on what Hunter's fame rests. In a busy professional life, he found little time to write and the contributions from his pen to medical information are meagre. His name has become attached to an opening in the fascia of the leg (Hunter's canal) but he did not describe it. His name is associated with an operation for aneurism but Hunter delegated the publication of this work to his brother-in-law. Being a frequent lecturer to medical students, many of his lectures were copied down by his students and later published. This has enabled us to obtain a more detailed knowledge of his work that he has left us in his own writings.

What then is the contribution of John Hunter to medicine?

John Hunter found surgery a highly developed art. He left it a true science and is today known as the founder of scientific surgery in England. At an early age he spent long hours in the dissecting-room of his brother, William Hunter. His mind found keen delight in tracing out complicated anatomic structures and in the natural development of these structures. At a very early period he studied the descent of the testis in the foetus and wrote *A description of the situation of the testis in the foetus, with its descent into the scrotum*, which is included in this number of MEDICAL CLASSICS.

He was fascinated by a study of the same anatomic form in man and in the lower animals. Whenever opportunity offered he obtained specimens of whatever animal he could lay his hands on and made as complete and detailed study of its anatomy and physiology as possible. He dissected more than five hundred different species of animals, many of them more than once, and left records of three hundred and fifteen dissections. Thus John Hunter is distinguished as a human and comparative anatomist and as a physiologist.

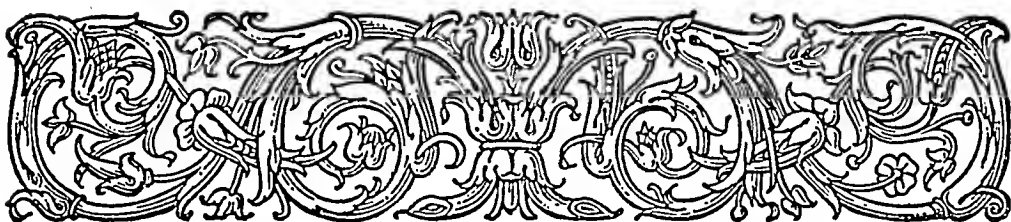
He was the founder of experimental and surgical pathology, a pioneer in comparative physiology and experimental morphology. The Hunterian Museum with thousands of specimens is supposed to have cost him over \$350,000.00. It was bought by the government after his death for \$75,000.00 and now forms the famous Hunterian Museum of the Royal College of Surgeons.

After returning to London from serving as surgeon in the Seven Years War, John Hunter became the most famous teacher of his day. Among his pupils were Astley Cooper, Abernethy, Physick, Thomson, Cline, and one whose name has become equally as famous, Edward Jenner, the discoverer of vaccination against smallpox.

One of John Hunter's most famous writings was *A treatise on the venereal disease*, published in 1786. This work was a standard text book until the middle of the nineteenth century. Today we know that it contains several gross errors. In Hunter's day gonorrhea and syphilis were considered to be two manifestations of one disease. Hunter performed experiments in which he inoculated himself with pus from what he thought was gonorrhea. A syphilitic lesion developed and this led him to the belief that these two diseases were really one. The description of his experiments is republished in this number of MEDICAL CLASSICS.

As early as 1761 Hunter began a study of inflammation. His work as an army surgeon gave him ample opportunity to carry on his observations but it was not until 1794, a year after his death that the book was finally published, *A treatise on the blood, inflammation and gunshot wounds*. Several chapters are republished herein.

John Hunter's position then as one of the three greatest surgeons is due him because he established surgery as a science. He did not look upon an injury simply as a condition to be dressed with an ointment compounded of many ingredients. He considered a wound in all of its phases of physiology and pathology and attempted to find nature's reason for healing or inflammation in that wound. He broke away from the popular trend of pure speculation to explain natural phenomena and on the basis of observation of comparative anatomy and physiology he attempted to discover the laws by which nature's actions are regulated.



## A Description of the Situation of the Testis in the Foetus, with Its Descent into the Scrotum<sup>\*</sup>

**A** DISCOVERY in any art not only enriches that with which it is immediately connected, but elucidates all those to which it has any relation. The knowledge of the construction of a human body is essential to medicine, therefore every improvement in anatomy must throw additional light on that branch of science. These improvements strike more forcibly if they are on subjects quite new or little understood; and this effect is well illustrated by the advantages which pathology has derived from the discovery of the lymphatics being the absorbent system; and likewise by that case of hernia, where the intestine lies in contact with the testicle; which has been perfectly explained by the discovery of the original seat of the testicle being in the abdomen.

Several years before Haller's *Opuscula Pathologica* were published, my brother informed me, that in examining the contents of the abdomen of a child, stillborn, about the seventh or eighth month, he found both the testicles lying in that cavity, and mentioned the observation with some degree of surprise. By this we are enabled to account for a circumstance that sometimes happens in the scrotal hernia, as depending on the discovery that the testis is formed in the abdomen, and which we could never

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explain to our satisfaction till the publication of the *Opuscula*, to which Dr. Hunter alludes, (*Commentaries*, page 72,) in the following words:

"In the latter end of the year 1755, when I first had the pleasure of reading Baron Haller's observations On the *Hernia Congenita*, it struck my imagination that the state of the testis in the foetus, and its descent from the abdomen into the scrotum, would explain several things concerning ruptures and the hydrocele, particularly that observation which Mr. Sharp had communicated to me, viz. that in ruptures the intestine is sometimes in contact with the testis. I communicated my ideas upon this subject to my brother, and desired that he would take every opportunity of learning exactly the state of the testis before and after birth, and the state of ruptures in children. We were both convinced that the examination of those facts would answer our expectation, and both recollected having seen appearances in children that agreed with our supposition, but saw now that we had neglected making the proper use of them.

"In the course of the winter my brother had several opportunities of dissecting foetuses of different ages, and of making some drawings of the parts; and all his observations agreed with the ideas I had formed of the nature of ruptures, and of the origin of the *tunica vaginalis propria* in the foetus. But till those observations were repeated to his satisfaction, and were sufficiently ascertained, he desired me not to mention the opinion in my lecture; and therefore, when treating of the coats of the testis, and of the situation of the hernial sac, &c., I only put in this temporary caution, that I was then speaking of those things as they are commonly in adult bodies, and not as they are in the foetus: and at last, when I was concluding my lectures for that season, in the end of April 1756, with a course of the surgical operations, I gave a very general account of my brother's observations, and showed both the drawing of fig. 2, which was then finished, and the subject from which it was made."

The following observations on this subject were taken from my notes, and published by Dr. Hunter in his *Commentaries*, to which I have added some practical remarks.

“Until the approach of birth, the testes of the foetus are lodged within the cavity of the abdomen, and may therefore be reckoned among the abdominal viscera. They are situated immediately below the kidneys, on the fore part of the psoas muscles, and by the side of the rectum, where this intestine is passing down into the cavity of the pelvis; for in the foetus, the rectum, which is much larger in proportion to the capacity of the pelvis than in the full-grown subject, lies before the vertebrae lumborum as well as before the os sacrum. Indeed the case is pretty much the same with regard to all the contents of the pelvis; that is, their situation is much higher in the foetus than in the adult. The sigmoid flexure of the colon, part of the rectum, the greatest part of the bladder, the fundus uteri, the Fallopian tubes, &c. being placed in the foetus above the hollow of the pelvis in the common or great abdominal cavity.

“While the testis remains in the abdomen its shape or figure is much the same as in the adult, and its position or attitude the same as when it is in the scrotum; that is, one end is placed upwards, the other downwards; one flat side is to the right, the other to the left; and one edge is turned backwards, the other forwards; and the vessels enter the posterior edge alike in both the foetus and adult. As the testis is not so immediately inclosed in the surrounding parts while it is in the loins, its position may be a little variable, and the most natural seems to be when the anterior edge is turned directly forwards; but as the least touch of anything will throw that edge either to the right side or to the left, then the flat side of the testis will be turned forwards. It is attached to the psoas muscle all along its posterior edge, except just at its upper extremity; and this attachment is formed by the peritoneum, which covers the testis and gives it a smooth surface, in the same manner as it envelopes the other loose abdominal viscera.

“The epididymis lies along the outside of the posterior edge of the testis, as when in the scrotum, but is larger in proportion, and adheres backwards to the psoas. When the foetus is very young, the adhesion of the testis and epididymis to the psoas is very narrow, and then the testis is more loose, and more projecting; but



as the foetus advances in months, the adhesion of the testis to the psoas becomes broader and tighter.

“The vessels of the testis, like those of most parts of the body, commonly rise from the nearest larger trunks, viz. from the aorta and cava, or from the emulgent.

“The artery generally rises from the fore part of the aorta, a little below the emulgent artery, and often from the emulgent itself, especially in the right side of the body, which may happen the rather, because the trunk of the aorta is more distant from the right testis than from the left. Sometimes, but much more rarely, the spermatic artery springs from the phrenic, or from that of the capsula renalis. Besides the artery which rises from the aorta, or emulgent, &c., the testis receives one from the hypogastric artery, which is sometimes as large as the other. It runs upwards from its origin, passing close to the vas deferens in its way to the testis. The superior spermatic artery sometimes passes before the lower end of the kidney; and both these arteries run in a serpentine direction, making pretty large but gentle turnings. They are situated behind the peritoneum, and both run into the posterior edge of the testis, between the two reflected laminae of that membrane, much in the same manner as the vessels pass to the intestines between the two reflected laminae of the mesocolon or mesentery.

“The veins of the testis are analogous to its arteries, but commonly change sides with the arteries respecting their origins from the emulgent. The superior spermatic vein, to begin with its trunk, rises commonly in the following manner: on the right side, from the trunk of the vena cava, a little below the emulgent; and on the left side, from the left emulgent vein. The reason of this difference between the right and left spermatic vein, no doubt, is because the cava is not placed in the middle of the body; so that by the rule of ramification which is observed in most parts of the body, the cava is the nearest large vein of the right side, and the emulgent is the nearest large vein of the left side. But the difference is inconsiderable; and accordingly we sometimes find the right spermatic vein coming from the right emulgent vein; and several other varieties are produced, which, so far as I can

observe, follow no precise rule. There is likewise a spermatic vein, which rises from the internal iliac, and runs up to the testis with the inferior spermatic artery. Both the spermatic veins run behind the peritoneum with their corresponding arteries, and go into the posterior edge of the testis, where they are lost in small branches.

“The nerves of the testis, like its blood-vessels, come from the nearest source; that is, from the abdominal plexuses of the intercostal, especially the inferior mesenteric plexus. They run to the testis, accompanying its blood-vessels, and are dispersed with them through its substance. The testis, therefore, with respect to its nerves, may be reckoned an abdominal viscus; and this observation will hold good when applied to the full-grown subject, as well as to the foetus; for those branches of the lumbar nerves which are commonly said to be sent to the testis, passing through the tendon of the external oblique muscle, in reality go not to the testis itself, but to its exterior coverings, and to the scrotum.”—p. 75.

The testicle receiving its nerves from the plexuses of the intercostal, accounts for the stomach and intestines sympathizing so readily with it and its particular sensation, and for the effects arising in the constitution upon its being injured.

“The epididymis begins at the outer and posterior part of the upper end of the testis, immediately above the entrance of the blood-vessels, where it is thick, round, and united to the testis. As it passes down it becomes a little smaller and more flat, and is only attached backwards to the testis, or rather indeed to its vessels; for its anterior edge lies loose against the side of the testis forwards; and at its lower end it is again more firmly attached to the body of the testis, so that in the foetus there is a cavity or pouch formed between the middle part of the testis and the middle part of the epididymis, more considerable than is commonly observed in full-grown subjects. As the body grows, the epididymis adheres more closely to the side of the testis; and its greatest part is made up of one convoluted canal, which becomes larger in size and less convoluted towards the lower end, and at last is manifestly a single tube running a little serpentine. That change

happens at the lower end of the testis, and there the canal takes the name of vas deferens.

"The vas deferens is a little convoluted or serpentine in its whole course, but is less so as it comes nearer to the bladder; instead of running upwards from the lower end of the testis, as it does when the testicle is in the scrotum, while that remains in the abdomen, it runs downwards and inwards in its whole course, so that it goes on almost in the direction of the epididymis, of which it is a continuation. It turns inwards from the lower end of the epididymis, under the lower end of the testis, and behind the upper end of a ligament or gubernaculum testis (which I shall presently describe); then it passes over the iliac vessels, and over the inside of the psoas muscle, somewhat higher than in adult bodies, and at last goes between the ureter and bladder towards the basis of the prostate gland."—p. 77.

In those animals where the testicles change their situation the cremaster muscle, which should be named *musculus testis*, has two very different positions in the foetus and in the adult, the first being the same as in those animals whose testicles remain through life in the cavity of the abdomen; we must therefore conclude that the same purposes are answered by this muscle in the foetus as in those animals.

The use of this muscle, when the testicle is in the scrotum, appears to be evidently that of a suspensory; for I find this muscle is strong in proportion to the size of the testicle and pendulous situation in other animals. But what purpose it answers in the foetus, or in animals whose testicles remain in the abdomen, is not easily imagined, there being no apparent reason why such a muscle should exist.

The cremaster, or *musculus testis*, appears to be composed of the lower fibres of the obliquus internus and transversalis muscles in the foetus, turning upwards, and spreading upon the anterior surface of the gubernaculum, immediately under the peritoneum; it appears to be lost on the peritoneum, a little way from the testicle. This, although now inverted, is more evidently seen in adult subjects who have had a hydrocele or rupture; in such cases the muscle becomes stronger than usual, and its fibres can

be traced spreading on the tunica vaginalis, and seem at last to be lost upon it, near to the lower end of the body of the testicle.

The nerves which supply this muscle are probably branches from the nerves of the obliquus internus and transversalis muscles; for the same cause which throws the abdominal muscles into action produces a similar effect on the musculus testis; which circumstance appears to be most remarkable in the young subject. When we cough or act with the abdominal muscles, we find the testicles to be drawn up; the musculus testis and abdominal muscles taking on the same action from the same cause.

“At this time of life the testis is connected in a very particular manner with the parietes of the abdomen, at that place where in adult bodies the spermatic vessels pass out, and likewise with the scrotum. This connexion is by means of a substance which runs down from the lower end of the testis to the scrotum, and which at present I shall call the ligament, or gubernaculum testis, because it connects the testis with the scrotum, and seems to direct its course through the rings of the abdominal muscles. It is of a pyramidal form; its large bulbous head is upwards, and fixed to the lower end of the testis and epididymis, and its lower and slender extremity is lost in the cellular membrane of the scrotum. The upper part of this ligament is within the abdomen, before the psoas, reaching from the testis to the groin, or to where the testicle is to pass out of the abdomen; whence the ligament runs down into the scrotum, precisely in the same manner as the spermatic vessels pass down in adult bodies, and is there lost. The lower part of the round ligament of the uterus in a foetus very much resembles this ligament of the testis, and may be plainly traced down into the labium, where it is imperceptibly lost. That part of the ligamentum testis which is within the abdomen is covered by the peritoneum all round except at its posterior part, which is contiguous to the psoas, and connected with it by the reflected peritoneum and by the cellular membrane. It is hard to say what is the structure or composition of this ligament; it is certainly vascular and fibrous, and the fibres run in the direction of the ligament itself, which is covered by the fibres of the cremaster or musculus testis, placed immediately behind

the peritoneum. This circumstance is not easily ascertained in the human subject; but is very evident in other animals, more especially in those whose testicles remain in the cavity of the abdomen after the animal is full grown.

“In the hedgehog the testes continue through life to be lodged within the abdomen, in the same situation as in the human foetus; and they are fastened by the same kind of ligament to the inside of the parietes of the abdomen at the groin. Now in that animal I find that the lowermost fibres of the internal oblique muscle, which constitute the cremaster, are turned inwards at the place where the spermatic vessels come out in other animals, making a smooth edge or lip by their inversion, and that then they mount up on the ligament to the lower end of the testis. Sometimes in the human body, and in many other animals, and very often in sheep, the testes do not descend from the cavity of the abdomen till late in life, or never at all. In the ram, when the testis is come down into the scrotum, the cremaster is a very strong muscle; and, though it be placed more inwards at its beginning, it passes down pretty much as it does in the human body, and is lost on the outside of the tunica vaginalis; but in the ram, whose testis still remains suspended in the abdominal cavity, I find that the cremaster still exists, though it is a weaker muscle; and instead of passing downwards, as in the former case, it turns inwards and upwards, and is lost in the peritoneum that covers the ligament which attaches the testis to the parietes of the abdomen, which in this state of the animal is about an inch and a half in length. In the human foetus, while the testis is retained in the cavity of the abdomen, the cremaster is so slender that I cannot trace it to my own satisfaction, either turning up towards the testis or turning down towards the scrotum. Yet, from analogy, we may conclude that it passes up to the testicle; since in the adult we find it inserted or lost on the lower part of the tunica vaginalis, in the same manner as in the adult quadruped.

“The peritoneum, which covers the testis and its ligament or gubernaculum, is firmly united to the surfaces of these two bodies; but all around, to wit on the kidney, the psoas, the iliacus internus, and the lower part of the abdominal muscles, that membrane

adheres very loosely to all the surfaces which it covers. Where the peritoneum is continued or reflected from the abdominal muscles to the ligament of the testis it passes first downwards a little way, as if going out of the abdomen, and then upwards, so as to cover more of the ligament than is within the cavity of the abdomen. At this place the peritoneum is very loose, thin in its substance, and of a tender gelatinous texture; but all around the passage of that ligament the peritoneum is considerably tighter, thicker, and of a more firm texture. When the abdominal muscles are pulled up so as to tighten and stretch the peritoneum this membrane remains loose at the passage of the ligament while it is braced or tight all around; and in that case the tight part forms a kind of border or edge around the loose double part of the peritoneum, where the testis is afterwards to pass. This loose part of the peritoneum, like the intro-suscepted gut, may, by drawing the testis upwards, be pulled up into the abdomen, and made tight, and then there is no appearance of an aperture or passage down towards the scrotum; but when the scrotum and ligament are drawn downwards, the loose doubled part of the peritoneum descends with the ligament, and then there is an aperture from the cavity of the abdomen all around the fore part of the ligament, which seems ready to receive the testis. This aperture becomes larger when the testis descends lower, as if the pyramidal or wedge-like ligament was first drawn down in order not only to direct but to make room for the testis which must follow it. In some foetuses I have found the aperture so large that I could push the testis into it as far as the tendon of the external oblique muscle.

“From this original situation within the abdomen the testis afterwards descends to its destined station in the scrotum; but it becomes difficult to ascertain the precise time of this descent, as we hardly ever know the exact age of our subject. According to the observations which I have made, it seems to happen sooner in some instances than in others; but generally about the eighth month. In the seventh month I have commonly found the testis in the abdomen; and in the ninth I have as commonly found it in the upper part of the scrotum. The descent being thus early,

and the passage being almost immediately closed, are the principal means of preventing the hernia congenita.

"At the before-mentioned period the testis moves downwards till its lower extremity comes into contact with the lower part of the abdominal parietes: when the upper part of the ligament, which hitherto was within the abdomen, has sunk downwards, it lies in the passage from the abdomen to the scrotum, and in that which is afterwards to receive the testis. As the testicle passes out it in some degree inverts the situation of the ligament passing down beyond it; what was the anterior surface of the ligament while in the abdomen, now becoming posterior and composing the lower and anterior part of the tunica vaginalis, on which the musculus testis is lost. This is more evident in those animals whose testicles can readily be made to pass up from the scrotum to the abdomen. The place where the ligament is most confined, and where the testis meets with most obstruction in its descent, is the ring in the tendon of the external oblique muscle; and accordingly I think we see more men with one testis or both lodged immediately within the tendon of that muscle than who have one or both still included in the cavity of the abdomen, which I shall take notice of hereafter.

"After the testis has got quite through the tendon of the external oblique muscle it may be considered as now in a way easily to acquire its determined station, though it commonly remains for some time by the side of the penis, and only by degrees descends to the bottom of the scrotum; and when the testis has descended entirely into the scrotum its ligament is still connected with it, and lies immediately under it, but is shortened and compressed.

"Having now given an account of the original situation of the testes, of the time of their descent from the abdomen, and of the route which they take in their passage to the scrotum, I shall in the next place describe the manner in which they carry down the peritoneum with them, and then explain how that membrane forms the tunica vaginalis propria in common and the sac of the hernia congenita in some bodies.

"While the testis is descending, and even when it has passed

into the scrotum, it is still covered by the peritoneum, exactly in the same manner as when within the abdomen, the spermatic vessels running down behind the peritoneum there as they did when the testis lay before the psoas muscle: that lamella of the peritoneum is united behind with the testis, the epididymis, and the spermatic vessels, as it was in the loins, and likewise with the vas deferens; but the testis is fixed posteriorly to the parts against which it rests, being unconnected and loose forwards, as while it remained in the abdomen. In coming down, the testis brings the peritoneum with it; and the elongation of that membrane, though in some circumstances it be like a common hernial sac, yet in others is very different. If we can imagine a common hernial sac reaching to the bottom of the scrotum, covered by the cremaster muscle; and that the posterior half of the sac covers and is united with the testis, epididymis, spermatic vessels, and vas deferens; and that the anterior half of the sac lies loose before all those parts, it will give a perfect idea of the state of the peritoneum, and of the testis when it comes first down into the scrotum. The testis therefore, in its descent, does not fall loose, like the intestine or epiploon, into the elongation of the peritoneum, but slides down from the loins, carrying the peritoneum with it; and both that and the peritoneum continue to adhere, by the cellular membrane, to the parts behind them, as they did when in the loins. This is a circumstance which I think may be easily understood, and yet that does not appear to be the case; for I find students very generally puzzled with it, imagining that when the testis comes first down it should be loose all round, like a piece of the gut or epiploon in a common hernia. The ductility of the peritoneum, and its very loose connexion by a slight cellular membrane to the psoas muscle, and all the other parts around the testis, are circumstances which favour its elongation and descent into the scrotum with the testis."

"This peculiarity of descent often takes place in some of the intestines; but can only happen in those which have adhesions to the loins. This I suspect is only to be met with in old ruptures, never happening at the first formation of the hernial sac, in which the intestine lies; and, I should suppose, could only form very



gradually. The caecum has sometimes been found to have descended into the scrotum, and to have brought along with it the adhesions through its whole course. The same thing has happened to the sigmoid flexure of the colon; and I have found the whole of it in the left side of the scrotum, with its adhesions brought down from the loins. Such herniae cannot be reduced; and in case of strangulation, which may be brought on by a fresh portion of intestine coming down, are not to be treated in the common way: the sac should not be opened, but the stricture divided, and the newly protruded part reduced.

“It is plain, from this description, that the cavity of the bag, or of the elongation of the peritoneum, which contains the testis in the scrotum, must at first communicate with the general cavity of the abdomen by an aperture at the inside of the groin. That aperture has exactly the appearance of a common hernial sac; the spermatic vessels and vas deferens lie immediately behind it, and a probe passes readily through it from the general cavity of the abdomen down to the bottom of the scrotum. And if this process of the peritoneum be laid open through its whole length on the fore part, it will be plainly seen to be a continuation of the peritoneum: the testis and epididymis will appear at the lower part of it, and the spermatic vessels and the vas deferens will be found covered by the posterior part of the bag in their whole course from the groin to the testis.

“Thus it is in the human body when the testis is recently come down; and thus it is, and continues to be through life, in every quadruped which I have examined where the testis is in the scrotum; but in the human body the communication between the sac and the cavity of the abdomen is soon cut off. Indeed I believe that the upper part of the sac naturally begins to contract as soon as the testis has passed through the muscles; which opinion is grounded on the following observation. In an instance where, from the age of the foetus and from every other mark, it was probable that the testis was very recently come down, and yet the upper part of the sac was very narrow, I pushed the testis upwards, in order to see if it could be returned. The attachments of the testis easily admitted of its ascent, and

so did the aperture in the tendon of the external oblique muscle; but the orifice and upper end of the sac would not by any means admit of the testis being passed quite up into the abdomen. However this may be, the upper end of the sac certainly contracts and unites first, and is quite closed in a very short space of time, for it is seldom that any aperture remains in a child born at its full time; and this contraction and union is continued downwards till it comes near the testicle, where this disposition does not exist, leaving the lower part of the sac open or loose through life even in the human subject, and forming the tunica testis vaginalis propria, the common seat of a hydrocele. Many cases of hydrocele in children seem to prove that the progress of this contraction and union is downwards; for in them the water commonly extends higher up the cord than in the adult, except in those of a considerable size; yet in some children this union seems not to take place regularly, being interrupted in the middle, and producing a hydrocele of the cord which neither communicates with the abdomen nor tunica vaginalis testis. The contraction and obliteration of the passage appears to be a peculiar operation of Nature, depending upon steady and uniform principles, and not the consequence of inflammation nor of anything that is accidental; and therefore, if it is not accomplished at the proper time, the difficulty of bringing about a union of the parts is much greater, as is seen in children who have had the sac kept open by a turn of the intestine falling down into the scrotum immediately after the testis. This looks as if Nature, from being balked when she was in the humour to do her work, would not or could not so easily do it afterwards. I shall readily grant that what has been advanced here as a proof of the doctrine may be explained upon other principles; but this at least is certain, that the closing of the mouth and of the neck of the sac is peculiar to the human species; and we must suppose the final intention to be the prevention of ruptures, to which men are so much more liable than beasts from their erect state of body."

In some cases the aperture of the sac is not entirely closed, allowing a fluid to pass down and form a hydrocele; which fluid, upon pressure, can be squeezed back into the belly; and instances

of this kind sometimes giving the idea of a gut being protruded, make it difficult to determine the exact nature of the case.

"What is the immediate cause of the descent of the testis from the loins to the scrotum? It is evident that it cannot be the compressive force of respiration; because the testis is commonly in the scrotum before the child has breathed, that is, the effect has been produced before the supposed cause has existed. Is the testis pulled down by the cremaster muscle? I can hardly suppose that it is; because, if that was the case, I see no reason why it should not take place in the hedgehog, as well as in other quadrupeds; and if the musculus testis had this power it could not bring it lower than the ring of the muscle.

"Why do the testes take their blood-vessels from such distant trunks? Those physiologists who have puzzled themselves about the solution of this question have not considered that in the first formation of the body the testes are situated not in the scrotum but immediately below the kidneys; and that therefore it was very natural that their blood-vessels should rise nearly in the same manner as those of the kidneys, but a little lower. The great length of the spermatic vessels in the adult body will not doubt occasion a more languid circulation, which we may suppose was the intention of nature.

"The situation of the testis in the foetus may likewise account for the contrary directions of the epididymis and of the vas deferens in adult bodies, though these two in reality make only one excretory canal. In the foetus the epididymis begins at the upper end of the testis; and it is natural, considering it is an excretory tube, that it should run downwards, and it is as natural that the rest of the tube, which is called vas deferens, should turn inwards at the lower end of the testis, because that is its most direct course to the neck of the bladder. Thus we see that in the foetus the excretory duct is always passing downwards. But the testis is directed in its descent by the gubernaculum, which is firmly fixed to the lower parts of the testis and epididymis, and to the beginning of the vas deferens, and thence must keep those parts invariably in their situation with respect to one another: and therefore in proportion as the testis descends the vas deferens must ascend from the lower end of the testis; and it must, from

the passage through the abdominal muscles down to the testis, run parallel with the spermatic vessels.

“The testis, its coats, and the spermatic cord are so often concerned in some of the most important diseases and operations of surgery, particularly in the bubonocoele and hydrocele, that their structure has been examined and described by the surgeons, as well as by the anatomists, of every age. Yet the descriptions of the clearest and best writers upon the subject differ so much from one another, and many of them differ so much from what is obvious and demonstrable by dissection, as to render it difficult to account for such a variety of opinions. The very different state of the parts in the quadruped and in the human body, no doubt, must have occasioned error and confusion among the writers of more ancient times, when the parts of the human body were described from dissections and observations made principally upon brutes: and the structure of parts, which are peculiar to the foetus, having been imperfectly understood, we may suppose, has likewise contributed to cause perplexity and contradiction among authors.

“Baron Haller, in his *Opuscula Pathologica*, has observed that in infants the intestine sometimes falls down into the scrotum after the testis, or along with it, and occasions what he calls the *hernia congenita*. In such a case the hernial sac is formed before the intestine falls down, as that ingenious anatomist has observed. There are, besides, two circumstances peculiar to a rupture of this kind, the intestine being always in immediate contact with the testis, and there being no *tunica vaginalis propria testis*. The structure of the parts in a foetus explains in the most satisfactory manner both these circumstances, however extraordinary they must appear to a man who has only been accustomed to view the parts in subjects of a more advanced age; and indeed it is so clear that it needs no illustration. It should be observed, however, that the *hernia congenita* may happen not only by the intestine falling down to the testis before the aperture of the sac be shut up, but perhaps afterwards; for when the sac has been but recently closed it seems possible enough that violence may open it again.

“It must likewise be obvious to every anatomist, who examines

the state of the testis in children of different ages, that the mouth and neck only of the sac close up, and that the lower part of the sac remains loose around the testis, and makes the tunica vaginalis propria. Whence it is plain that this tunic was originally a part of the elongated peritoneum; and, as it is undoubtedly the seat of the true hydrocele, it is also plain that the hernia congenita and the true hydrocele cannot exist together in the same side of the scrotum. For when there is a hernia congenita there is no other cavity than that of the hernial sac; and that cavity communicates with the general cavity of the abdomen.

"The observations contained in the two last paragraphs occurred to my brother upon reading Baron Haller's *Opuscula Pathologica*, and gave rise to my inquiries upon this subject."—*Medical Commentaries*, part i, p. 83.

Having explained the situation of the testicles in the foetus, and their descent, with the circumstances attending it, I shall next consider the cases in which the change takes place, in one or both testicles, later than the usual or natural time. And having remarked the consequences of this descent at so late a period, I shall take notice of those instances in which the testicles never pass out of the abdomen.

I have said that the early descent of the testicles, and closing of the mouth of the sac, by usually happening before birth, prevent likewise the descent of any part of the abdominal viscera; but when the testicles remain in their first situation beyond this period these advantages are lost; a part of the intestines or epiploon being, under these circumstances, liable to descend along with them.

The first or natural process, in some instances, not having been begun, or having been interrupted before birth, it becomes afterwards very uncertain when the descent will be completed; yet I think the completion most frequently happens between the years of two and ten, while the person is young and growing, being seldom delayed beyond the age of puberty.

It is not easy to ascertain the cause of this failure in the descent of the testicle; but I am inclined to suspect that the fault originates in the testicles themselves. This however is certain, that

the testicle which has completed its descent is the largest, which is more evident in the quadruped than in the human subject; as in these we can have an opportunity of examining the parts when we please, and can determine how small in comparison with the other that testicle is which has exceeded the usual time of coming down: it never descends so low as the other.

The descent of that testicle is very slow which is not completed before birth, often requiring years for that purpose; and it sometimes never reaches the scrotum, especially the lower part of it. There is oftener I believe an inequality in the situation of the two testicles than is commonly imagined, being seldom equally low in the scrotum; and I am of opinion that the lowest is the most vigorous, having taken the lead readily, and come to its place at once. The part where it meets with the greatest difficulty in its descent is in the division of the tendon of the external oblique muscle called the ring.

How far an erect position of body, the action of the abdominal muscles, and the effect produced upon the contents of the abdomen in breathing may contribute mechanically to the descent of the testicles when the natural operations of the animal economy have failed, I will not pretend to decide; but when we see these combined actions producing an unnatural descent of a portion of intestine, we may conceive that they are likewise capable of contributing to the descent of the testicle.

When the testicle has remained in the cavity of the abdomen beyond the usual time, it is impossible to say whether the disposition for closing up the passage, after it has passed out, is in any degree lost or not; but when it comes down after birth, we can easily suppose a portion of intestine or epiploon is more likely to descend and prevent the closing of the mouth of the sac, than before the child was born, when certain actions had not taken place. We should therefore watch this descent of the testicle, and endeavour, by art, to procure that union which the natural powers are either not disposed to perform, or are prevented from completing by the descent of other parts: but art should not be used too soon, nor till the testicle has got a little way below the ring. As this progress is very slow, especially when the testicle

is creeping through the ring, a doubt often arises whether it is better entirely to prevent its passage, or to assist it by exercise or other means; and it would certainly be the best practice to assist it, if that could be done effectually and safely. When it has got upon the outside of the tendon it can in general be easily pushed up again into the abdomen; and in these two situations it will sometimes play backwards and forwards for several years, without ever coming low enough to allow of the use of artificial means to hinder its descent, or to prevent a rupture. In this case it becomes difficult to determine what should be done; but, from what I have seen, I should be inclined to wait the descent, giving it every assistance in my power. Indeed, in all cases I would advise waiting with patience, for in most of those which I have seen, years have elapsed from the first appearance of the testicle under the ring of the abdominal muscle before it has reached that situation in which we may safely apply a truss. I never have perceived that any inconvenience has arisen from waiting, and the danger, if there is any, may be in some degree avoided. I have always recommended moderate, not violent exercise.

When the testicle has got some way below the ring, then the case is to be treated as an inguinal hernia, and a truss applied upon the ring; taking care that the testicle is not injured by it; but as this generally happens at too early a period for the patients themselves to be capable of attending to it, the surgeon who is employed should be very attentive, and those in whose immediate care they are, particularly watchful, that no inconvenience is produced by the truss. I have, however, known a rupture happen in a man thirty years old, where the testicle had not even got into the ring. In such a case I think a truss should be immediately applied; for if it is thought advisable to prevent the testicle from coming down, a truss is equally adapted for that purpose, as for hindering the descent of an intestine where there is an hernial sac.

It sometimes happens that one of the testicles remains in the cavity of the abdomen through life, never acquiring the disposition to change its situation; therefore the person naturally

concludes that he has only one testicle; and it can only be known that he had two by an examination of these parts after death; it is, however, possible that in some instances one may be wanting; but, if we are to reason from analogy, we must suppose this to be a very rare case; for it is a very common circumstance, that many quadrupeds have only one testicle in the scrotum; and in such as are killed for food, and from that circumstance come more particularly under observation, if this peculiarity has been noticed, we in general find the other testicle in the cavity of the abdomen; though in some instances they are both found lying in that cavity.

When one or both testicles remain through life in the belly, I believe that they are exceedingly imperfect, and probably incapable of performing their natural functions, and that this imperfection prevents the disposition for descent from taking place. That they are more defective than even those which are late in passing to the scrotum, is to be inferred from what is very evident in quadrupeds, the testicle that has reached the scrotum being in them considerably larger than the one which remains in the abdomen. It is probable that this peculiarity is a step towards the hermaphrodite, the testicle being seldom well formed. I have only seen one case in the human subject where both testicles continued in the abdomen; this proved an exception to the above observation, since we are led to conclude that they were perfectly formed, as the person had all the powers and passions of a man. In such cases nothing is to be done by art, as it is not possible to give the testicles the stimulus of perfection, which I believe is necessary to make them assume the disposition requisite for their descent; and the ring of the external oblique muscle is perhaps less liable, in such instances, to allow a portion of intestine to push down, than where the testicles have passed through it; and such persons may probably be more secure from accidents of this kind than if they had been more perfectly formed.

The testicle, in changing its situation, does not always preserve a proper course towards the scrotum, there being instances of its taking another direction, and descending into the perinaeum. How this is brought about is difficult to say; it may



possibly be occasioned by something unusual in the construction of the scrotum; or, more probably, by a peculiarity in that of the perinaeum itself; for it is not easy to imagine how the testicle could make its way to the parts about the perinaeum if these were in a perfectly natural state.

The first instance of this kind that occurred to me was the child of a shopkeeper in Oxford-street, which I visited, in company with Dr. Garthshore, about the year 1775; but what became of the patient afterwards I do not know. I have lately been consulted, in a similar case, by Mr. Hunt, a surgeon, at Burford in Oxfordshire, whose apprehensions of what may be the consequences of a testicle remaining in the perinaeum appear to be well founded. The most effectual method of obviating these will probably be to support the testicle in a situation near the groin, by the application of a bandage that may hinder its descent into the perinaeum, by which the parts may be in time so consolidated as to retain it by the side of the scrotum.

“Dear Sir,

“I take the liberty of writing to you, in consequence of having met with a *lusus naturae* of a peculiar kind, in the son of a man in this neighbourhood.

“The boy is about twelve months old: his right testicle is situated about an inch below the termination of the scrotum, and half an inch on the right side of the centre of the *rapha perinaei*, where a kind of pouch is formed of the common integuments, without the least rugous or scrotal appearance on its surface. It is perfectly detached from the scrotum; nor can the testis or spermatic process be at any time felt in any part of the scrotum, though I can readily make the testis pass from its situation quite up into the groin; but immediately upon removing my hand the testis falls down into its pouch; and I can trace the spermatic cord from the body of the testis up to the ring, running about a fourth of an inch on the right side of the scrotum. The scrotum on each side appears perfectly formed, and the left testis is *in situ naturali*. Now, Sir, as I conceive this peculiar conformation may be attended with great inconvenience to the child when

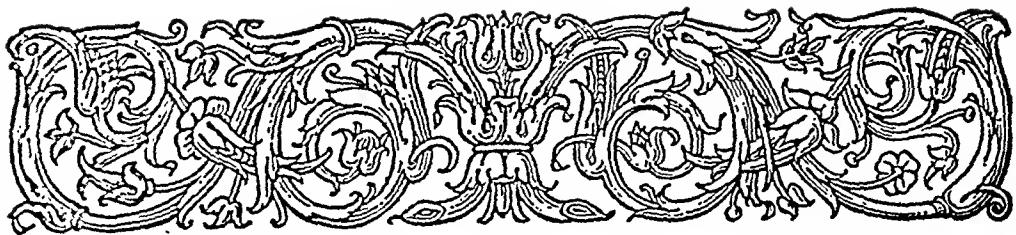
he comes to ride on horseback, and on many other occasions, I beg leave to request your opinion upon it, with respect to what ought to be done to prevent accidents, which must, if left in its present situation, often occur.

*"Burford, Oxfordshire.*

(Signed) Thomas Hunt."

To illustrate the descriptions which I have given, I have annexed three figures that were carefully taken from nature. (See Plates XXV. and XXVI.)

NOTE: The three figures of Plates XXV and XXVI have not been reproduced.—E. C. K.



# Observations on the Inflammation of the Internal Coats of Veins

Read February 6, 1784

(From the Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, Vol. I, p. 18, 1793)

**T**HE following observations will show that the inside of veins, as well as of all other cavities, is a seat of inflammation and abscess. I have found in all violent inflammation of the cellular membrane, whether spontaneous or in consequence of accident, as in compound fractures, or of surgical operation, as in the removal of an extremity, that the coats of the larger veins, passing through the inflamed part, become also considerably inflamed, and that their inner surfaces take on the adhesive, suppurative, and ulcerative inflammations; for in such inflammations I have found in many places of the veins adhesion, in others matter, and in others ulceration. Under such circumstances the veins would have abscesses formed in them, if the matter did not find in many cases an easy passage to the heart along with the circulating blood, so as to prevent the accumulation of the pus; but this ready passage of the matter into the common circulation does not always happen. It is in some cases prevented by the adhesive inflammation taking place in the vein between the place of suppuration and the heart, so that an abscess is formed, as will be further observed.

Where the inflammation is most violent there we find the vein most inflamed, there also after suppuration we find the purest pus; and as we trace the vessels from this part, either farther

from or nearer to the heart, we find the pus more and more mixed with blood, and having more of the coagulated parts of the blood in it.

As these appearances are only to be seen in dead bodies, they cannot be described but from thence; but it is so common a case that I have hardly ever seen an instance of suppuration in any part furnished with large veins where these appearances were not evident after death. I have found them in the bodies of those who have died from amputations, compound fractures, and mortifications.

These circumstances all considered lead us to account for a very frequent complaint, that is, an inflamed arm after bleeding: a complaint which has by some been imputed to the wounding of a tendon, because the tendon of the biceps muscle lies under some of those veins in which we often bleed, and when the complaint occurs it is unjustly supposed to arise from want of skill in the operator; by others it has been supposed to arise from the wounding of a nerve; and again it has been laid to the charge of a bad constitution.

But if we consider more critically this consequence arising from bleeding, we shall find that it happens frequently after bleeding in veins where no tendon could possibly be wounded, and also where no particular nerve could be in the way. It seems likewise to happen as frequently in constitutions where there is no appearance of want of health, as in those disposed to disease. As a proof of this last, upon bleeding in another vein in the same person, perhaps with a view to assist in the cure of the inflammation arising from the first bleeding, the wound was healed very readily.

If we examine the proportion which the number of those inflammations that happen after bleeding bears to those which arise from as slight a wound where no large vein has been injured, and even perhaps where the wound has not been made by so clean a cutting instrument, and the same pains not taken to close it up, we shall find that those from wounded veins are much the most frequent, and that such inflammations seldom or ever happen under the last-mentioned circumstances: there-

fore we must look for some other cause to explain this effect of bleeding.

The manner in which those sore arms came on shows plainly that they arise from the wound not healing by the first intention: for the external wound in most cases first festers or inflames, then suppurates and ulcerates, so that the cavity of the vein becomes impervious. In some this suppuration is only superficial, the vein and parts below having united. In others the skin shall appear to be united, but not close to the vein, so that a small abscess shall form between the skin and the vein; it shall burst and discharge a thin watery fluid, and no further mischief happen; but when this imperfection of union is continued on to the cavity of the vein, then the vein inflames both upwards and downwards, and that often for a considerable way, and the surrounding parts join in the inflammation.

We find all these variations in different cases: for the disease sometimes goes no further than an inflammation in the vein near to the orifice, which is often resolved; at other times the inflammation is carried further, but suppuration is prevented by the adhesive inflammation taking place in the vein at this part, so as to exclude the suppurative inflammation, and the veins in such cases may be plainly felt, after the surrounding tumefaction has subsided, like hard cords. But this salutary effect is not always produced, and suppuration in the vein is the consequence; but often so confined, that only a small abscess forms in the cavity of the vein near to the orifice. The confinement of the matter in this part of the vein arises from adhesions in the vein a little above and below the orifice. But in many cases the inflammation and suppuration are not confined to this part, from the adhesions not having taken place; for it frequently happens that an abscess is formed, occupying a considerable length of the vein both ways; and we often have more than one abscess, nay at times there is a series of them, and generally in the direction of the vein, between the orifice and the heart; but not always in this course, for we find them sometimes between the wound and the extreme parts.

I have seen from a wound in the foot the vena saphaena in-

flamed all up the leg and thigh, nearly as high as the groin; and I have been obliged to open a string of abscesses almost through its whole course.

In cases where I have had opportunities of inspecting veins after death in which the inflammation had been violent, upon examining the vein at some distance from this violence, I found the inflammation in the adhesive state: in some places the sides of the vein were adhering, and in others the inner surface of the veins was furred over with a coagulable lymph. Where different abscesses had formed I have always found that the spaces of the vein between them had united by the adhesive inflammation, and it is this union which circumscribes the abscesses.

Upon examining the arm of a man who had died at St. George's Hospital, I found the veins, both below and above the orifice, in many places united by the adhesive inflammation. I also found in many parts of the veins that suppuration had begun, as we find, on an inflamed surface, but had not yet arrived at ulceration; and in several other places ulceration had taken place, so as to have destroyed that surface next the skin, and a circumscribed abscess was formed. The vein near to the axilla had taken on suppuration, beyond which adhesions had not formed, and this had given a free passage for the matter into the circulation, of which most probably the patient died.

In those cases where larger abscesses have come on than those formed simply from the ulceration of the wound made by the lancet, I have always found that the vein was afterwards obliterated, having united and healed up as any other cavity does, so that such patients could never be bled in the same vein again, which is a proof that the sides of the vein can unite by the adhesive inflammation.

Inflammation of a vein is a common effect after bleeding horses, which is usually done in the neck. The operator on this animal does not always take sufficient care to close up the external wound; for although the method usually employed would at first sight appear to be a good one, that is, by a pin passed through the wound from side to side, as in the hare-lip, and over-tied by a thread or hair, yet, if not executed with sufficient atten-

tion, I should be inclined to believe that it is the very worst, as it very readily promotes inflammation in the cavity of the vein, either of the adhesive or suppurative kind, according as the ligature does or does not communicate with the cavity.

In some of these inflammations of horses I have seen the jugular vein inflamed through its whole length, and all the side of the head has been considerably swelled, and the inflammation carried along the vein quite into the chest. In these cases there is always an abscess formed at the wound, and often several along the vein, as in the human subject; and whenever the complaint is carried so far as this stage, the cavity becomes united at those places by granulations, and the vein is ever after impervious. Many horses die of this disease; but what is the particular circumstance which occasions their death I have not been able to determine. It may either be that the inflammation extends itself to the heart, or that the matter secreted from the inside of the vein passes along that tube in considerable quantity to the heart, and mixes with the blood.

I am inclined to believe that the exposure of cavities of the larger veins in cases of accidents, and also of operations, is often the cause of many of the very extensive inflammations which sometimes attend these cases, and indeed may be the reason why inflammations extend or spread at all beyond the sphere of continued sympathy.

In all cases where inflammation of veins runs high, or extends itself considerably, it is to be expected that the whole system will be affected. For the most part the same kind of affection takes place which arises from other inflammations, with this exception, that where no adhesions of the sides of the veins are formed, or where such adhesions are incomplete, pus passing into the circulation may add to the general disorder, and even render it fatal.

In all cases of inflammation where adhesions take place they arise from an extravasation of coagulable lymph; but how such adhesions should take place on the internal surface of veins appears at first sight difficult to conceive, since it is most obvious that the coagulable lymph thrown out by the exhalants on the internal surface of the vein, mixing with the same fluid circulating

with the other parts of the blood, would be swept away without producing any effect. But since such adhesions do in fact happen, the coagulable lymph must undergo some change connected with the disposition which produces its extravasation.

Although the operation which is the most frequent cause of this complaint is to appearance trifling, yet as it is often of very serious consequence, both to the life of the patient and the character of the surgeon, it requires particular attention in the operator to prevent as much as possible an evil of such magnitude. With this view he will be particularly attentive to the mode of closing the wound and binding up the arm. This is to be done by bringing the two sides of the wound together, that they may unite by the first intention. To accomplish this, let the surgeon, with the thumb of that hand which holds the arm, push the skin towards the orifice, while he draws it on the other side to the same point with the compress: thus the skin will be thrown into folds at the wound over which he is immediately to apply the compress. The compress should be broad, to keep the skin better together; and thick, to make the compression more certain. Another advantage arising from this caution is the prevention of the vein bleeding a second time. I have known an inflammation attack the orifice, which appeared to have arisen from the first union having been broke through, and no second union formed; but this probably did not arise from the vein being opened a second time, but from the sides of the orifice not having been again brought together. I would recommend a compress of linen or lint, in preference to sticking plaster; for I imagine that the blood drying over, the orifice is a kind of bond of union more natural and effectual than any other application: and this conclusion is drawn from practice; for I have seen more sore arms in consequence of bleeding where plasters have been afterwards applied, than from any other; and in cases of the compound fracture, when attempted to be cured as a simple fracture, if the wound will allow of being scabbed over, I have seen it always do well; whereas if it has been kept moist, or prevented from evaporating by plasters or other applications, it has always suppurated.

When inflammation takes place beyond the orifice, so as to



alarm the surgeon, he should immediately make a compress upon the vein at the inflamed part, to make the two sides adhere together; or if they do not adhere, yet simple contact will be sufficient to prevent suppuration in this part; or if inflammation has gone so far as to make the surgeon suspect that suppuration has taken place, then the compress must be put upon that part of the vein above the suppuration. This I once practised, and, as I supposed, with success.

THE END



An Account of Mr. Hunter's  
Method of performing the  
Operation for the Popliteal  
Aneurism. Communicated in  
A Letter to Dr. Simmons by  
Mr. Everard Home, Surgeon<sup>\*</sup>

*To Dr. SIMMONS*

SIR,

**I**N consequence of your request, I send you an account of Mr. Hunter's method of performing the operation for the popliteal aneurism, which you will please to insert in the next part of the Medical Journal, if you think it deserving of a place in that publication.

I am, Sir,

Yours, &c.

Everard Home.

The common method of operating in cases of popliteal aneurism having, in many instances, proved unsuccessful, the operation itself has been condemned by some of our most eminent surgeons.

If we consider the cases in which it has been performed, and where the patients have died, we shall probably find that in all

<sup>\*</sup>London Medical Journal, 7: 391-406, 1786.

of them the artery had been diseased at the part enclosed by (p. 392) the ligature, and had either sloughed off, or had been cut through where it was tied, so that the sides of the artery, though brought together, had not remained a sufficient length of time in that situation to unite by the first intention, and the patients lost their lives from the consequent hæmorrhage.

The femoral and popliteal arteries are portions of the same trunk, presenting themselves on different sides of the thigh, and are readily come at in either situation; but where the artery is passing from the one side to the other, it is more buried in the surrounding parts, and cannot be exposed without some difficulty. In performing the operation for the popliteal aneurism, especially when the tumour is large, the ligature is commonly applied on the artery at that part where it emerges from the muscles. This will be too limited a space, should it prove diseased for some way higher up; and if the artery should afterwards give way from any of the causes above mentioned, there will not be a sufficient length of vessel remaining to allow of its being again secured in the ham. To follow the artery up through the insertions of the Triceps muscle, to get at a portion of it where it is sound, becomes a very disagreeable (p. 393) part of the operation; and to make an incision upon the fore part of the thigh, to get at and secure the femoral artery, would be breaking new ground—a thing to be avoided, if possible, in all operations.

From these considerations, suggested by the accident of the artery giving way, which happened several times to Mr. Hunter; he proposed, in performing this operation, that the artery should be taken up at some distance from the diseased part, so as to diminish the risk of hæmorrhage, and admit of the artery being more readily secured, should any such accident happen. The force of the circulation being thus taken off from the aneurismal sac, the cause of the disease would, in Mr. Hunter's opinion, be removed; and he thought it highly probable that if the parts were left to themselves, the sac, with the coagulated blood contained in it, might be absorbed, and the whole of the tumour removed by the actions of the animal œconomy, which would consequently render any opening into the sac unnecessary.

The operation was first performed in this way at St. George's hospital, and the result which I have here annexed does credit to Mr. Hunter's observation; and so far as one case can establish (p. 394) a general practice, it seems to be an improvement of considerable importance.

A. B. about forty-five years of age, a coachman, was admitted into St. George's hospital in December, 1785, with a popliteal aneurism, which he had perceived for three years, and had observed it gradually to increase during the whole of that period. It was so large as to distend the two ham strings laterally, and make a very considerable rising between them; the pulsation was very distinct, and could be felt on every side of the tumour. That leg and foot were so much swelled as to be a great deal thicker than the other, and were of a mottled brown colour; the swelling was not of the œdematous kind, but felt firm or *brawny*, being a consequence of the extravasation of coagulating lymph, so that the leg retained its natural shape.

Mr. Hunter having determined to perform the operation, a tourniquet was previously applied, but not tightened, that the parts might be left as much in their natural situation as possible; and he began the operation by making an incision on the fore and inner part of the (p. 395) thigh, rather below its middle, which incision was continued obliquely across the lower edge of the sartorius muscle, and was made large to give room for the better performing of whatever might be necessary in the course of the operation: the fascia, which covers the artery, was then laid bare for about three inches in length, and the artery being plainly felt, a slight incision, about an inch long, was made through this fascia along the side of the vessel, and the fascia dissected off, by which means the artery was exposed. Having disengaged the artery from its lateral connexions by the knife, and from the parts behind it by means of the end of a thin spatula, a double ligature was passed behind it by means of an eyed probe, and the artery tied by both portions of the ligature, but so slightly as only to compress its sides together; a similar application of ligature was made a little lower; and the reason for passing four ligatures was

to compress such a length of artery as might make up for the want of tightness, as he chose to avoid great pressure on the vessel at any one part. The ends of the ligatures were carried directly out at the wound; the sides of which were now brought together, and supported by sticking plaster and a linen (p. 396) roller, that they might unite by the first intention.

The limb was found, some hours after the operation, not only to retain its natural heat, but to be even warmer than the other leg. The second day after the operation the brawny firmness of the leg was considerably diminished; it was become soft, loose, and a good deal smaller, and the aneurismal tumour appeared to have lost more than one third of its size.

Nothing could shew more plainly the action of the absorbents than the change the leg underwent in so short a time. The diminution of the tumour probably arose from the fluid blood which it contained having passed into collateral branches, or the tibial artery.

The fourth day, on the removal of the dressings, the edges of the wound were found united through its whole length, excepting where prevented by the ligatures; there was neither pain nor tumefaction in the part, but the aneurismal tumour was much the same as on the second day.

On the ninth day after the operation there was a considerable discharge of blood from the part where the ligatures passed out; a tourniquet was therefore applied on the artery above, (p. 397) which stopped the bleeding; and although the tourniquet was taken off a few hours after, no blood followed. The head of a roller was now placed upon the wound, in the direction of the artery, and over that the tourniquet, which was not tightened more than was thought sufficient to take off the impetus of the blood in that portion of the artery.

On the tenth day appearances were much the same, only that between the compress and the knee there appeared a little fulness like an approaching inflammation. On the eleventh day this was gone off, and on the fifteenth some of the ligatures came away, followed by a small discharge of matter, and the tumour in the ham was lessened. On the seventeenth day the parts

surrounding the aneurismal tumour were more reduced and pliable, so that it became distinct.

About the latter end of January, 1786, six weeks after the operation, the patient went out of the hospital, the tumour at that time being somewhat lessened, and rather firmer to the feel. He was ordered to come to the hospital once every week, and, in the mean time, to make some degree of pressure by applying a compress and bandage, with a view to excite (p. 398) the absorbents to action, which, in this as in most cases, had a good effect.

About the middle of February the tumour had decreased, and was become still firmer. March the 8th the wound, which had cicatrized, broke out again, and the patient was taken into the hospital. About the 8th of April some remaining threads of the ligature came away, and an inflammation appeared upon the upper part of the thigh. In the middle of May a small abscess broke at some distance from the old cicatrix, at which opening some matter was discharged, but no pieces of ligature were observed. Several small threads were, at different times, discharged at the old sore, and the swelling subsided; but the thigh soon swelled again to a greater size than before, attended with considerable pain. In the beginning of July a piece of ligature, about an inch in length, came away; after which the swelling subsided entirely, and he left the hospital the 8th day of July, at which time there remained no tumour in the ham, and he was in every respect well.

(p. 399) This mode of performing the operation being in itself evidently more simple, and in every respect less dangerous than the method commonly practiced, it is unnecessary to enumerate all the circumstances in which it deserves the preference: but, before I conclude, it will be proper to observe, that Mr. Hunter now rather disapproves the application of a number of ligatures, in the manner practised in the above case, as these cannot come away without producing ulceration on that part of the artery which they enclose, a tedious process when the ligature is not drawn tight; neither do I believe he would again be inclined to heal up the wound by the first intention, but rather to allow

the cut surface to inflame and suppurate, by which he would have it more in his power to come at the artery, should that prove necessary; and probably, by means of the dressings, he might make a gentle compression to assist the ligatures.

It will not be improper here to observe, that surgeons have laid too much stress on the necessity of large, collateral branches being present, to insure the success of this operation: this must have arisen more from their anatomical knowledge, than from observations made from (p. 400) practice, since we find that the trunk of the femoral artery may be taken up in any part of the thigh, without producing mortification of the limb. In one patient afflicted with aneurism, whose limb Mr. Hunter examined after his death, though there was great reason to believe that the artery had been obliterated above the great muscular branch, the limb had been very well nourished.

Since the above account was drawn up, this mode of performing the operation has been practised, in a case of aneurism of the femoral artery, by Mr. Birch, surgeon to St. Thomas's hospital; and as the operation, in that instance, was not attended with success, the failure might by some be attributed to the mode in which it was performed, and the above account might be considered as a partial one; to do away these objections, I requested Mr. Birch to favour me with the particulars of the case, that my account of the consequences of the operation might be more complete; and although it was disagreeable to me to ask for the recital of an unsuccessful case, I was well assured that Mr. Birch was too disinterested, and too anxious to promote the improvement of his profession, to make the least objection to the (p. 401) case being laid before the public: and I have since been fully confirmed in my opinion by his ready compliance with my request.

I have given the case, with the dissection of the body after death by Mr. Cline, exactly as they were communicated to me by Mr. Birch.

#### “CASE

“John Lewis, a negro, aged forty-three years, received a blow on the anterior part of the right thigh. About a month after

he perceived a small tumour, which gradually increased, and his own expression was, that he could feel it *thump, thump*.

"As the tumour enlarged, he came to London for advice, applied at St. Thomas's hospital on Thursday the 26th of October last, and was directly admitted. On examination, I found a large tumour, extending within two inches of Poupart's ligament upwards, and occupying two thirds of the thigh; a pulsation could be felt, and there was no doubt of the disease being an aneurism of the femoral artery.

"I directed seven ounces of blood to be taken from the arm, and an opiate to be (p. 402) given at night. The patient rested well, and the next day a consultation was held, in which it was proposed to perform an operation, and endeavour to pass a ligature round the femoral artery, giving the patient the chance of nourishing the limb by the arteria profunda, and other anastomosing vessels.

"On Friday the 3d of November it was determined to perform the operation. Mr. Cline undertook to compress the artery as it passed through Poupart's ligament, which he easily effected with a hard compress in the shape of a T with a broad basis.

"It was agreed, previous to the operation, that an incision should be carried in a semi-lunar form round the upper part of the aneurismal sac, in order to make room for the longitudinal incision necessary to dissect down to the artery. This was accordingly done, and the integuments raised, so as to make room to feel for the pulsation of the artery. Some portion of cellular membrane, and some lymphatic glands, were necessarily dissected and removed; with my fingers I then separated the muscular fibres, and tore away the connecting parts, till the artery could be plainly felt in pulsation. It was (p. 403) then necessary to divide a part of the fascia covering the artery, which was done by carrying the back of the knife on Mr. Cline's nail, while his finger pressed upon the naked artery; after which the finger and thumb could surround and compress the vessel. An eye probe, armed with a strong flat ligature, was then pushed through the cellular membrane, and carried under the artery. This being effected, we had such command of the vessel as to be able to strip it down, and pass another ligature somewhat lower.



This last ligature was then tied, the first being left loose to secure us against accident.

"The threads being separated and secured, the wound was lightly dressed, the tumour left in its natural situation, and the patient put to bed, with the loss of only four or five ounces of blood during the operation. No pulsation could be perceived in the tumour after the ligature was tied.

"On Saturday, November 4th, he had slept well, was easy, and there was sufficient warmth in the extremity to assure me of some circulation.

"On the 5th the discharge from the wounded lymphatics was so abundant as to make (p. 404) it necessary to remove the superficial dressings. The tumour was rather softer to the touch, and the skin about the apex of it began to shrivel.

"The discharge of lymph continued till the 9th, and then the wound began to digest, affording, however, a very small quantity of pus. The tumour grew thinner at one point, and seemed as if disposed to ulcerate the integuments. This day I passed a bleeding ligature round the leg, just below the knee, and the veins tumified sufficiently to have bled freely, if they had been punctured.

"10th, He was feverish in the evening.

"11th, He had stools from some laxatives I had directed, and was better.

"12th, The tumour was very thin in one part, and a fluctuation evidently to be felt. The limb was warm and moveable, but the patient was feverish and delirious at night. A decoction of bark, with a sedative bolus, were directed for him, but he would not take them.

"13th, The wound looked florid, and afforded good pus. The patient was feverish (p. 405) and delirious; the tumour was threatening to burst. This day he took his medicines.

"14th, He became sensible, but was languid and hot; the tumour burst, and discharged serum and grumous blood; he fainted; the dressings were not disturbed; he slept composedly; fainted again about six o'clock in the evening, and expired. I saw him at seven, when the limb was still warm; I removed the

dressings, and found a small stream of fresh arterial blood, which had issued from the wound.

"It appears probable, that if the patient had applied for relief before the tumour was so much enlarged, the operation might have succeeded, as we should then have been able to have tied the sound artery so much lower down.

"J. BIRCH.

### "DISSECTION

"The body was examined the morning after the patient's death. The integuments on the middle of the tumour were mortified. The blood contained in the tumour was very putrid, and the greater part of it fluid; it appeared to be dissolved by putrefaction.

(p. 406) "Water, injected by the external iliac artery, escaped freely from the wound at the ligature, where the artery was open and appeared to have ulcerated at that part.

"In dilating the artery from the ligature to the heart, its internal surface appeared of a bright red. This appearance lessened at the curvature of the aorta, yet it was very evident of its semilunar valves.

"The arteria profunda, which passed off from the femoral artery rather less than half an inch above the ligature, was also inflamed within. There were near two inches of the femoral artery between the ligature and the aneurismal sac, the internal surface of which was of the usual white colour; from this a membranous-like substance could be peeled off, that seemed to be coagulable lymph.

"The opening, where the artery passed out of the aneurismal sac, was near three inches below the part where it entered. In opening this part of the artery, from the sac to the ham, it appeared quite sound, and of its natural colour.

"H. CLINE."

*Green Street,  
Leicester Square,  
Nov. 30, 1786.*



# A Treatise on the Blood, Inflammation, and Gunshot Wounds\*

## PART I

### CHAPTER I

#### GENERAL PRINCIPLES OF THE BLOOD

**A**S THE blood is allowed by all to have a considerable share in inflammation, or at least to be particularly affected by it, becoming by its appearances, one of the signs or symptoms of its existence, and as the blood is a material object with me in the theory of inflammation, I shall begin my treatise with its natural history, a previous knowledge of which is the more requisite, because the accounts of this fluid hitherto given will hardly explain any of its uses in the machine in health, or of its changes in disease.

The heart and vessels are very active in inflammations; and as their structures and actions have not hitherto been understood, I have subjoined to the natural history of the blood an account of the structure of the heart and vessels, together with their actions in the machine; to which I have added one use of the absorbents not hitherto known.

As every natural action of the body depends, for its perfection, on a number of circumstances, we are led to conclude, that all the various combining actions are established while the body is in health, and well-disposed; but this does not take place in diseased actions, for disease, on the contrary, consists in the want

\*The Works of John Hunter, edited by J. F. Palmer. London, Longman, 1837, vol. III.

of this very combination; and diseased actions, therefore, vary according to many natural circumstances, of which I propose to point out a few of the most striking instances.

Inflammation must have some exciting cause, and the same cause will produce an effect under one circumstance which it will not under another. I have therefore begun with the supposition of an injury, attended with such circumstances as do not excite inflammation, which will form a strong contrast to those which do, the opposite effects mutually illustrating each other; but as the inflammation is a very general action of the vessels in disease, and is of various kinds, I have previously given a short account of several of the most common sorts of inflammation, which will explain the rest.

The whole material world has been very properly divided into solids and fluids, these being the only essential different states of matter we are able to observe. From one of these states to the other matter appears to be continually passing, but with these restrictions, that no species of matter can assume a solid form without having first been in a fluid state, nor can any change take place in a solid till it be first formed into or suspended in a fluid. The living animal body is obedient to these general laws, for all solid and animal matter has first been fluid, and having passed into this solid form, becomes a recipient for other fluids, out of which the solids may themselves be renovated and increased.

The solids of an animal, although composed of one species of matter, yet admit of great variety in their appearance; and this variety takes place in some animals more than in others. But the fluid part of an animal body, in its natural state, has but one appearance, which is that of blood. There are certain parts of animals which, though hardly solid in their own nature, are yet to be considered as solids, from their being fixed in their situation, and appropriated to local actions; some of them acting on the fluids (which are, to a certain degree, passive in all animals), and disposing of them for particular purposes in the animal œconomy, in the same manner as is done by those which are usually called the solids in animals; of this sort are the gelatinous

parts in many of the inferior orders of sea-animals, as the medusa, the vitreous humour of the eye, &c. There appears to be a sympathetic intercourse between the solid and fluid parts of an animal, designed by nature for their mutual support. In disease, when the machine cannot be furnished in the common way, the solids of the body supply the defects, and the person becomes lean; and the fluids would appear from this to be more an object of attention in the machine than even the solids.

This fluid part of an animal is called the blood, and in the animals with which we are most acquainted it is of a red colour. The nature and appearances of the blood have been more attended to in diseases, especially of the inflammatory kind, than in full health, as it is more expressive of disease when removed from the body than any of the solids, and undergoes changes which the solids do not. Some of these changes are produced by the separation of parts from one another; but as the body is seldom in perfect health, we can hardly procure the blood in the same state twice from one person, although it may not be sensibly diseased. In a history of the blood these varieties must be mentioned, although they are often slighter appearances of what we find in disease; for disease certainly throws great light on the natural history of the blood, and the apparent changes which it undergoes must have unavoidably called medical men to consider it with attention.

The only knowledge, however, we have of any difference in the blood, arises from those varieties in its spontaneous changes when extravasated; nor do these differences appear always to affect the real nature of the blood, as the animals often continue in health while they are going on.

Blood is most probably as much alike in all animals as the muscle of one animal is like that of another, only with this difference, that some animals have not that part which gives it the red colour; but the other parts, as the lymph and serum, are, as far as I yet know, the same in all.

Transfusion of the blood of one animal into the vessels of another proves, to a certain degree, the uniform nature of the blood, for, as far as these experiments have been urged, no alteration has been observed.

Concerning natural objects, we usually acquire a gross knowledge, from the frequency with which they are observed, and it often requires little more than common attention to have a tolerable conception of their general principles. This is the case with the blood.

Blood is known to be of a red colour in a great number of animals, and to be altogether a fluid while circulating in the living body. It is known to separate into parts when out of the body, and a portion of it to become solid; it is likewise known, that when deprived of a certain proportion of it, an animal dies; it has, therefore, been held in particular veneration, as constituting the life of the animal. Like other things which are discovered to be of great use, the blood has frequently attracted the attention of mankind as an object of curiosity only, from which some have proceeded to a more critical inquiry into its nature and properties, and to a more extensive elucidation of the subject at large. To this practitioners in physic have a great deal contributed, from a conviction that this knowledge would be of much use to them in their profession; and the teachers of the art have been still more industrious in their investigations; but the frequent recourse which is had to the lancet in diseases has afforded the most ample opportunities of observation, almost sufficient to explain every principle in the blood, without the aid of further experiment.

In animals possessed of red blood, two modes of investigation may be adopted. One of these respects the blood while circulating, when the colour makes its motion visible and gives an idea of the circulation in the smaller vessels. Accidents, operations, and anatomical knowledge of the vessels in which the blood is contained, have at the same time assisted us to form more perfect ideas of its motion in the larger vessels. The other mode, which is that of examining the blood when out of the body, enables us to observe whatever relates to its spontaneous changes and separation, together with the apparent properties of each component part. Its chemical properties become known likewise by this second mode, though without throwing much light on the nature of the fluid itself.

The blood is called a fluid because it is always found in a

fluid state in the vessels of a living animal while under the influence of the circulation; yet it is not, under all circumstances, naturally so, for of one part of it, when not circulating, solidity is a necessary and essential property, fluidity being only necessary at the time of circulation for its motion, distribution, and the easy separation of its parts.

Without being fluid, it could not be propelled through flexible tubes, and distributed to all parts of the body. It could not be divided into portions, as the vessels branch off; it could not pass through the smaller vessels, nor admit of the various separations of its parts, which are to produce the increase and repairs of the whole body; neither could it be adapted for furnishing the various secretions; nor could it be brought back to the heart.

The red colour of the blood is produced merely by some red matter diffused through it, but not common to all animals. The blood exhibits a greater variety of changes, and admits of more experiments to determine its nature and properties, than the solids. This, in some degree, arises from its fluidity, in which form it has not yet attained its ultimate state, and is only the substance that furnishes materials out of which the solids are produced or augmented.

The heat in the animal body, principally in those which are called warm animals, has been commonly considered as depending principally on the blood, or at least as being connected with it as much as with any other portion of the body. As I shall have occasion to take notice of the increased heat of inflamed parts, it might be expected that I should endeavour to explain this principle in the history of the blood. I profess, however, not thoroughly to understand it, and the theories hitherto brought forward do not in the least satisfy me, as I think that none of them accord perfectly with every circumstance observable in these cases.

#### *1. Of the Mass of Blood, as composed of different Parts*

The blood, while circulating in the vessels, appears to the eye to be a homogeneous mass; but when it is passing in vessels so small as almost to separate its visible parts, and is viewed in a

microscope, there is no appearance but that of globules moving in the vessels.

In such a situation the other parts, called the coagulable lymph and the serum, are not distinguishable, on account of their being transparent, and the globules do not, strictly speaking, constitute a part of the fluid, but are only diffused through it. These globules being red, give this colour to the blood, and are called the red part, but are not always of the same redness when collected in a mass; this is probably owing to each globule being changed in its tint of colouring. The blood of some animals has no such globules, but is perfectly transparent, indeed more so than the most transparent parts of the red blood, to which it is analogous. A red colour is therefore not essential to constitute true blood; and I believe the slight tinge of colour there is in the blood, independent of the globules, arises from the solution of various substances in the serum. The blood has a peculiar taste, being saltish, but of a peculiar flavour: we can always distinguish by the taste when there is blood in the mouth.

These are the principal observations we can make on the blood when circulating, or in its fluid state; but as one part of it under circumstances changes into a solid, or as it is commonly termed, coagulates, more of its parts are thus exposed; in this process the blood separates into two distinct substances, a coagulating part, and another which separates from it and remains fluid; but the coagulum entangles the red part, and this alone shows the blood to be formed of these component parts. The parts of the blood so separated have been named according to their apparent properties; the one, the coagulable lymph; the other, the serum; and the red part has been called the red globules; but upon a more intimate knowledge of the different parts of this fluid, we shall find that those terms are not expressive of all their properties.

The term *coagulable* lymph is not expressive of this property, as one which is inherent in the lymph itself, for many substances are capable of being coagulated, though not spontaneously, yet by chemical means. For instance, heat coagulates the farinaceous part of vegetables, and thus forms paste, and also mucus.



Spirits of wine coagulates many animal substances; acid coagulates milk, &c.; the term, therefore, to be used respecting this property of the blood should be such as expresses its inherent power of self-coagulation: perhaps *coagulating* might be better applied to what is called *coagulable* lymph, and the epithet coagulable might be reserved for those fluids which require a chemical process to produce that effect. Of this kind is the serum, for I have discovered this fluid to be composed of two parts, which is ascertained by means of the different causes of coagulation. To discover all the various properties and uses of the component parts of the blood in the machine may be impossible; and to determine whether they will act, or are employed conjunctively to produce the effect, is not easy; but there are some properties discoverable which would incline us to believe that particular parts of the blood are employed to compose particular solid parts, which are found to possess properties similar to different parts of the blood.

### *2. Of Coagulation, and its Effects*

As coagulation is the first change which the blood undergoes when out of the vessels, and as it even coagulates while in them, under certain circumstances, we shall consider this process first. Though fluidity is necessary to enable the blood to circulate, yet coagulation is no less necessary when it is to be disposed of out of the circulation, even within the body, and therefore deserves to be considered with no less attention. There is, I think, more to be learned of the use of blood in the animal œconomy from its coagulation than from its fluidity. The coagulation of the blood, when out of the circulation, would seem to be unconnected with life, yet life could not go on without it; for as all the solid parts of the body are formed from the blood, this could not take place if there did not exist in it the power of coagulating. Many diseases exhibit the blood coagulated in the living body, even in the vessels themselves, but more frequently when extravasated. Coagulation does not belong to the whole mass of circulating blood, but only to the part I have called coagulating lymph, which during this action commonly detaches itself from the other part, called the serum.

Whether the whole mass of the serum be a distinct part of the blood when circulating is not easily determined, as we have no mode of separating it from the coagulating lymph, while both are fluid. The serum making a part of the whole mass in the fluid state, the first state in the coagulation is a species of decomposition, forming a separation of the serum. But, on the other hand, there are reasons for considering the coagulating lymph as distinct from the serum, even when both are fluid; since the serum can be separated from the lymph without coagulating, by many actions of the vessels, both natural, preternatural, or diseased. Thus the liquor of the amnios and that of dropsies are formed; and therefore we may conclude that the separation of the serum, when the lymph is coagulated, is not an act necessary to the coagulation, but an effect of it.

The circumstances attending the coagulation of the lymph are subject to great varieties. These depend upon or correspond with the state of the body at the time, of which we can best judge by the readiness or difficulty with which the blood coagulates, and by the firmness or looseness of the coagulum. The whole mass of the blood being a compound, of which the parts are in some degree separated, the appearances upon coagulation are attended with still more variety than the lymph alone could exhibit, or than could occur in those animals which are not possessed of red blood, as the red part brings to view many of the changes in the lymph, by the difference of its colour, as well as of its specific gravity.

The three substances, which become visibly distinct when the lymph coagulates, differ as to gravity: the serum is the lightest, and, remaining fluid, swims upon the top; the red globules, which undergo no change, are the heaviest, and sink more or less in the lymph; but being entangled in it, add to its weight, so as to make it sink deeper in the serum.

Blood when extravasated coagulates sooner or later, according to the quickness or slowness of its extravasation, and the quantity extravasated: it coagulates late when drawn into a basin rapidly, and in considerable quantity; soon, when allowed to flow slowly, and in small quantities. This will be better understood when I treat of the principles of coagulation.

When blood is received into a cup, and is thereby exposed, it certainly coagulates more readily than when extravasated in the cellular membrane or in the vessels; and on the exposed surface it coagulates more readily than anywhere else, except round the edges of the dish in which it is contained. It has been observed that the upper surface of the blood coagulates first, forming a thin pellicle, as milk does when near boiling, while underneath it still remains fluid; but the whole gradually becoming thicker, and losing its transparency, coagulates in about fifteen or twenty minutes into a substance of pretty thick consistence. The time required will vary according to the quantity of blood in one mass and the disposition of the blood at the time.

We may observe the following appearances when the blood is coagulated. The coagulum is generally, but not always, swimming in a fluid; for it sometimes happens that the lymph does not squeeze out the serum in the act of coagulation, in which there is an act of contraction. The top of the coagulum is toughest or firmest: and it becomes less and less so towards the bottom, because there is less of the coagulating lymph at the bottom, in proportion as the red globules subside in the lymph before it coagulates. The coagulating lymph has a degree of toughness in proportion as it is free from serum; for while the serum is mixed within it, though there may be no red globules, it is not very tough; but when pressed between the finger and thumb, so as to squeeze out the serum, it becomes nearly as tough and elastic as the coats of an artery, to appearance becoming fibrous, and even forming laminae, and indeed appears to be very much the same kind of substance with an artery, which gives us a clear idea how a membrane may be formed, and probably can be varied, according to the impression made on it by the surrounding parts. This is one reason why the lymph, which has the strongest disposition for coagulation, is the toughest, as it parts with more of its serum. The lymph is transparent, but whether tinged as the serum is found to be we can hardly say, as it is seldom possible to catch it in a fluid state free from red globules, and never from serum, which has itself a tinge. When out of the body in a dish, where it is long in coagulating and the red glob-

ules sink fast, we find it transparent; but during coagulation it becomes more muddy, till at last it is opaque, but with a tinge of colour. On being steeped in water it is often rendered very white, which would not probably be the case if it had a tinge of its own, independent of the serum.

Blood usually requires a considerable time for its complete coagulation, or rather contraction; for if allowed to stand some days, the coagulated part becomes less and less, as more and more of the serum is squeezed out, which cannot arise from the serum being lighter and issuing out spontaneously, for without some expelling force it would be retained mechanically by the capillary attraction, as in a sponge. The blood which is longest in coagulating coagulates most strongly, and produces the most complete separation of its parts. In such instances, as the coagulating lymph continues longer fluid, it allows the red globules more time to subside, and the serum to be more squeezed out from the crassamentum. When the coagulation is slow, and of that kind which will be firm when completed, we may skim off the fluid coagulating lymph, free from the red globules; and the part so taken will coagulate immediately, while that in the cup remains fluid some time longer.

Many causes have been assigned for the coagulation of the lymph, which appear to me to be ill founded. It frequently happens that when changes take place in matter of which the immediate causes are unknown, the mind refers them to some circumstances which accompany these changes, although, perhaps, they may have had no concern whatever in producing them, and may be only attendants. This will always be the case where those changes arise out of the nature of the part itself. A seed put into moist ground grows; but the moist ground is only a necessary attendant, and not the immediate cause. The life of the seed, stimulated to action by the moisture, is the immediate cause of its growth, and it continues to grow because its action is always excited. All the water in the world would not make a dead seed grow. The same mode of distinction is applicable to the coagulation of the lymph.

The first observations on the blood were most probably made

on that of the more perfect animals, whose heat is commonly greater than the heat of the atmosphere. Such blood when extravasated was found to coagulate on cooling; it was therefore natural to suppose that the coagulation of the lymph arose from its becoming colder, as happens in jelly; but cold, simply, has certainly no effect upon the coagulating lymph.

If we take a fish out of the sea, the heat of its body perhaps about  $60^{\circ}$ , and bring it into an atmosphere of  $70^{\circ}$ , the blood, on being let out of the vessels, will immediately coagulate. This was ascertained on board of a ship lying off Belleisle, in the summer 1761; for immediately upon a fish being caught, I ascertained its heat, and letting out part of its blood, it immediately coagulated, although the blood discharged was become warmer than that remaining in the vessels of the fish; which, however, still continued fluid.

Indeed, common experience and observation shows us that cold alone has no power to coagulate the blood. It often happens that particular parts of an animal, such as the fingers, face, nose, ears &c., are cooled nearly to the freezing-point, and frequently are in that state for a considerable time, yet the blood retains its fluidity in those parts, as I have experienced in my own fingers; and indeed in those parts of an animal where the blood has been frozen, and again thawed, the blood appears as fluid as before, and circulates as usual. Heat has the power of exciting action in an animal, and we find that heat even increases the action of coagulation; for if blood be heated to about  $120^{\circ}$ , it will coagulate five minutes sooner than when kept at its natural heat, and even sooner than the blood of the same animal taken at the same time and cooled to  $50^{\circ}$ . Mr. Hewson has laboured this point, endeavouring to show it is not cold that makes the blood coagulate, and he has laboured no less to show the real cause of such a change.

He took fresh blood and froze it quickly; on being thawed, it was again fluid, but soon afterwards coagulated; this he conceived to be a sufficient proof that it was not cold which made the blood coagulate.

From the above observations and experiments, it must appear

that cold, simply, has no influence whatever upon the coagulation of the blood.

And in most of the cases in which the blood is observed to coagulate, the air is commonly in contact with it; this was next presumed to be the cause of its coagulation. But the air has really no more effect than any other extraneous body, in contact with the blood, that is capable of making an impression upon it; for the blood coagulates more readily in a vacuum than in the open air: nor will either of these supposed causes assist in explaining why it is not found coagulated after many kinds of death, nor in the menstrual discharge. Neither will they account for the very speedy coagulation of the blood which usually takes place in all the vessels after death, or when it has been extravasated into cavities, or cellular membranes, where no air has ever been admitted.

Rest is another cause upon which the coagulation of the blood has been said to depend; and although this opinion be not true in the full extent in which it has been taken, I think that rest has greater influence in the change than any other circumstance whatever. But though rest seems greatly to dispose the blood to coagulation, it is the operation of rest alone, without exposure, which we are to consider; as otherwise we shall be apt to confound it with the two foregoing causes, viz. cold, and the contact of air.

Since, therefore, the blood may coagulate in the vessels either of a living or a dead body, and since it coagulates when extravasated into different parts of a living body, rest, like cold or air, might be supposed to be the sole cause of the coagulation of the blood: yet it is not rest considered simply, but rest under certain circumstances, which appears to possess such a power; for motion given to the blood, out of the vessels, will not of itself prevent its coagulation; nor will it even in the vessels themselves, if all the purposes of motion are not answered by it. Motion seems to retard coagulation; yet we know for certain that blood will in time coagulate even in the vessels themselves, and under certain circumstances sooner, perhaps, than anywhere else: as, for instance, when there is a disposition to mortification. In this case we find the blood coagulated even in the larger vessels.

I have seen a mortification come on the foot and leg, and when it had advanced only to a certain degree, the patient died. On examining the parts above the mortified part, I found the crural and iliac arteries filled completely with strong coagulated blood: we may thence infer that the tendency to mortification in the vessels produced this disposition in the blood. If the coagulation should be supposed to have arisen from the blood being stopped in the large vessels at the mortified part, let us reflect that this cannot account for it: the same thing ought then to happen in an amputation, or in any case where the larger vessels are tied up.

In a priapism the blood does not coagulate, except it threatens mortification.

The separation of the blood, either from itself, that is when divided into small portions, or separated from the living body, becomes one of the immediate causes of the coagulation of the lymph; therefore the contact of blood with blood, or with living vessels, in some degree retards coagulation: this is the reason why blood which comes from the vessels slowly, or falls from some height, or runs some way on the surface of a dish, coagulates sooner than when the contrary circumstances happen; and upon this principle it is, that blood when shaken in a phial will coagulate the sooner, even if shaken in a vacuum. A deep mass of blood is also, from the same cause, longer in coagulating than a shallow one.

From the above observations it must appear evident that neither cold, nor air, nor rest, alone, has any influence on the coagulating power of the blood; there must, therefore, be some other principle on which this process depends; and, as it retains its fluid state while circulating, and even for a long time when at rest in the living vessels, and coagulates when the vessels or the body dies, it might naturally be supposed that it was the life of the body or vessels which kept it fluid; we know, however, that life in the body or vessels does not hinder the blood from coagulating under certain circumstances, but often rather excites coagulation. Nor does death, in the body or vessels, in all cases become a cause of coagulation; for we find that in many

who die suddenly from a strong impression of the mind, the blood does not coagulate; there is, therefore, something more than the mere situation of the blood, surrounded with dead parts, that allows of coagulation; and that must be a something in the blood itself.

From these observations it must be evident that the fluid state of the blood is connected with the living vessels, which is its natural situation, and with motion; and that where there is a full power of life, the vessels are capable of keeping the blood in a fluid state. I believe, however, very little motion is required to keep up this fluidity when the other is present. A total stagnation of the blood while the body is alive, as in a trance, or where the circulation has been stopped for several hours, as in the case of persons apparently drowned, does not make it coagulate; yet where there are no actions going on in a part, if the blood stagnates for a much shorter time than in a trance, it will be found coagulated, as in mortifications; but then this coagulation is to answer a good purpose, and arises from necessity, which appears to act as a stimulus in disposing the blood to coagulate.

As a proof that blood will not coagulate in living vessels, in a perfect and natural state, and ready to act when powers were restored to it, I found that the blood of a fish, which had the actions of life stopped for three days, and was supposed to be dead, did not coagulate in the vessels; but, upon being exposed or extravasated, soon coagulated.

The blood of a lamprey-eel, which had been dead to appearance some days, was found fluid in the vessels, because the animal was not really dead; there had, however, been no motion in the blood, as the heart had ceased acting; but upon its being exposed, and extravasated in water, it soon coagulated: yet, under certain circumstances in life, it has been observed that the blood will in a small degree coagulate; this is in the state of torpor. It is asserted by some author, whom I now do not recollect, that the blood of a bat coagulates when in that state; and Mr. Cornish, (surgeon, at Totnes, in Devonshire,) to whom I applied for some bats in the torpid state, sent me them, but in the carriage they always died: however, he took opportunities of examining them,



and he found that the blood was in a certain degree coagulated; but it soon recovered its fluidity on motion and heat.

From these remarks, I should conclude that rest does not of itself in the least assist the coagulation of the blood, but that this effect arises from the blood being separated from the living vessels, and being deprived of motion; and that it happens sooner or later, according to other circumstances. It might be supposed that these are rather negative causes of coagulation than positive ones; but it is to be considered, that in a living body the cessation of a natural action, the absence of an usual impression becomes a cause of action, of which innumerable instances may be given.

I have now considered the circumstances under which the blood coagulates, and shown that none of them alone, nor all them combined, induce the blood to coagulate. My opinion is, that it coagulates from an impression; that is, its fluidity under such circumstances being improper, or no longer necessary, it coagulates to answer now the necessary purpose of solidity. This power seems to be influenced in a way in some degree similar to muscular action, though probably not entirely of that kind; for I have reason to believe that blood has the power of action within itself, according to the stimulus of necessity, which necessity arises out of its situation.

I shall now consider the simple act of coagulation, abstracted from causes.

Coagulation I conceive to be an operation of life; and I imagine it to proceed exactly upon the same principle as the union by the first intention; it is particle uniting with particle, by the attraction of cohesion, which, in the blood, forms a solid; and it is this coagulum, uniting with the surrounding parts, which forms the union by the first intention; for union by the first intention is no more than the living parts when separated, whether naturally or by art, forming a reciprocal attraction of cohesion with the intermediate coagulum, which immediately admits of mutual intercourse, and, as it were, one interest.

To produce coagulation of the blood, however, something more is required than merely the reverse of the causes above mentioned, as having the power to keep it fluid; for the blood

becomes in many cases instantaneously incapable of coagulation, either in or out of the vessels, even when nothing has been added or taken away, and must be therefore under the influence of some other cause. This, I believe, must be sought in some property inherent in the blood itself: besides, some natural operations destroy this principle in the blood when extravasated.

In many modes of destroying life the blood is deprived of its power of coagulation, as happens in sudden death produced by many kinds of fits, by anger, electricity, or lightning; or by a blow on the stomach, &c. In these cases we find the blood, after death, not only in as fluid a state as in the living vessels, but it does not even coagulate when taken out of them. As in the bodies of such persons no action of life takes place, the muscles do not contract. There are partial influences likewise which destroy the power of coagulation, as a blow on a part producing a considerable extravasation. This forms an ecchymosis, in which we shall often find the blood not in the least coagulated. In healthy menstruation the blood which is discharged does not coagulate; in the irregular or unhealthy it does. The healthy menses, therefore, show a peculiar action of the constitution; and it is most probably in this action that their salubrious purposes consist; for if twice the usual quantity is evacuated, with the power of coagulation, even from the same vessels, the same benefit is not produced, much less when taken away from another part by art.

Many substances, when mixed with the blood, prevent coagulation; bile has this effect out of the body; but we cannot suppose that in a living body it can be taken into the blood in such quantity as to produce this effect; for we find in a very severe jaundice that the blood is still capable of coagulating strongly.

That probably every inanimate fluid in nature, which is capable of being rendered solid, produces heat during that change, and in the contrary change cold, is commonly known. It is on this principle that Dr. Black has established his very ingenious theory of latent heat. Thus, in the freezing of water heat is produced.

To see how far the coagulation of the blood was similar in this

respect to the same change in other substances, I first coagulated the white of an egg, by applying to it rectified spirits of wine: the heat of both was the same before their union; but I found, upon uniting them, that the white of the egg was immediately coagulated, and that the heat of the mixture was increased four, sometimes five degrees, according as it coagulated slowly or quickly.

As the blood in the animals upon which we most commonly make our experiments is warm, it becomes a difficult matter to ascertain whether it produces heat upon coagulation. In holding the ball of the thermomenter in the stream of blood coming from the arm, I found the heat raised to  $92^{\circ}$ : I then took a cup of human blood, allowed it to coagulate, and put it up to the brim in water warmed to  $92^{\circ}$ , till the whole mass was heated to this point. I bled afterwards another person to the same quantity, in a similar cup, which was put into the same water. Having two well-regulated thermometers, one in each cup of blood, I observed which cooled first, for I did not expect so much heat to be produced in the second as to make it warmer, but conceived, if any heat was formed, it would retard the cooling of the fresh blood; but it rather cooled faster, which I imputed to the coagulated blood parting with its heat slower than the fluid blood. These experiments I have repeated several times, with nearly the same effect. I then conceived the experiment would be more conclusive if I could get blood in a fluid state which was naturally of the heat of the atmosphere, for which purpose I took the blood of turtles.

A healthy turtle was kept in a room all night, the floor of which was about  $64^{\circ}$  and the atmosphere  $65^{\circ}$ . In the morning the heat was nearly the same. The thermometer was introduced into the anus, and the heat of that part was  $64^{\circ}$ . The animal being suspended by the hind legs, the head was cut off at once, and the blood caught in a bason; the blood while flowing was  $65^{\circ}$ , and when collected was  $66^{\circ}$ , but fell to  $65^{\circ}$  while coagulating, which it did very slowly: it remained at  $65^{\circ}$ , and when coagulated was still  $65^{\circ}$ . These experiments had been made several times, but not with that nice accuracy which was obtained by causing

all the heats to correspond exactly; yet, as they were all known and marked down, if any heat had been produced upon coagulation its exact quantity would have been ascertained in each; and, indeed, in some it seemed to cool, but in none it became warmer. From these experiments, I should say that in the coagulation of the blood no heat is formed.

Coagulated blood is an inorganized animal substance. When the blood is thinly spread before coagulation, or oozes out on surfaces, (in which act it immediately coagulates,) and coagulates in that form, it may then be said to form an inorganized membrane, of which there are many; and organization is seemingly so simple in many (which we know to be constituent parts of the body), that these coagula, more especially the thin ones, cannot easily by their appearances be distinguished from them.

The coagulating lymph of the blood being common probably to all animals, while the red particles are not, we must suppose it from this alone to be the most essential part; and as we find it capable of undergoing, in certain circumstances, spontaneous changes, which are necessary to the growth, continuance, and preservation of the animal, while to the other parts we cannot assign any such uses, we have still more reason to suppose it the most essential part of the blood in every animal.

Besides a disposition for coagulation under certain circumstances, as before described, the blood has also a disposition for the separation of the red globules, and probably of all its parts; for I think I have reason to believe that a disposition for coagulation, and a disposition for a separation of the red part, are not the same thing, but arise from two different principles. Indeed, a disposition to coagulation would counteract the effect, and hinder the separation of the red particles from taking place. Thus we see that rest, or slow motion of the blood in the vessels, gives a disposition towards the separation of the red part, as well as when it is extravasated; since the blood in the veins of an animal acquires a disposition to separate its red parts more than in the arteries, especially if it be retarded in the veins; the nearer, therefore, to the heart in the veins the greater will the disposition for separation be; though it does not seem to retard coagulation.

This is always observable in bleeding; for if we tie up an arm, and do not bleed immediately, the first blood that flows from the orifice, or that which has stagnated for some time in the veins, will soonest separate into its three constituent parts: this circumstance exposes more of the coagulating lymph at the top, which is supposed by the ignorant to indicate more inflammation, while the next quantity taken suspends its red parts in the lymph, and gives the idea that the first small quantity had been of such service at the time of its flowing as to have altered for the better the whole mass of blood. Rest, therefore, may be regarded as one of the immediate causes of the separation.

## PART II

### CHAPTER II

#### FUNDAMENTAL PRINCIPLES OF INFLAMMATION

An animal in perfect health is to be considered as a perfect machine, no part of it appearing naturally weaker than another; yet this is not strictly true; but still if no relative action, with regard to external matter, was to take place, the machine would, in itself, be tolerably perfect for its own actions. As the animal, however, is employed upon common matter, and therefore liable to accidents, which interrupt the natural operations, it becomes absolutely necessary for its continuance that it should possess, within itself, the power of repair; we find it accordingly endowed with powers of repair upon many such occasions; but where parts give way from their own natural actions, this mischief cannot be repaired; because, if they are not able to sustain their own actions, they cannot recover when diseased or injured. It is found that some structures of parts more readily give way than others, and consequently are much longer in repair, either when diseased or injured by accident. We also find that different situations, of similar parts, give them advantages or disadvantages with regard to their powers of restoration. This is principally known from injuries being done to them, or in consequence of those injuries from the attack of a disease. It is also shown in the common actions of the body or parts, of which, in health, we have comparative trials. We never can know what a thing

is incapable of doing till it gives way, which giving way is either a disease, or that which is productive of disease: nor can we know the powers of restoration in the part till it is tried.

As a proof that parts cannot always be proportioned to the action or powers applied which have no action within themselves, but are only acted upon by external force, we adduce the instances of a broken patella or broken tendo Achillis, or a thickening of the valves of the heart. In the first, however, there is commonly another power superadded besides simply the actions of the parts, viz. the body falling and being stopped at once. In the valves of the aorta, however, and the valvula mitralis, we have the best examples, for they become thickened from the actions of the parts themselves; while no such effect takes place in the valves of the pulmonary artery: even an aneurism proves the same.

Where there is a difference in structure there are comparative powers to resist the consequences of actions, attended with injury, such as their admitting more or less readily of thickening, ulceration, or mortification, and their comparative powers of restoration. When we compare the power of restoration in muscle, nerve, cellular membrane, ligament, tendon, bone, etc. with each other, they are found to be very different. Muscles, skin, and probably nerves, possess the greatest powers of that kind; and the cellular membrane, ligament, tendon, bone, etc. the least and are, in this respect, pretty equal among themselves. How far elastic ligaments have powers of resistance and repair I do not know, but I should suppose they have them in a very considerable degree, from the vessels not giving way so readily as in many of the others.

Their comparative powers become pretty evident in most of their diseases, but chiefly, I think, in mortification. A mortification is the most simple effect of debility, it gives the comparative powers of parts in the most simple manner. We find that muscles, skin, and often blood-vessels, stand their ground, while they are deprived of their connecting membrane, which has either sloughed off or ulcerated; tendons likewise slough off as far as these muscles, and stop there.

I have also observed, that difference in the situation of similar

structures in the body makes a material difference both in the powers of resistance to injuries, and of reparation when injuries have taken place. This difference seems to arise in proportion to the distance of the parts from the heart, or source of the circulation. Thus we see muscles, skin, etc. becoming more readily diseased in the legs than anywhere else, and more slow in their progress towards a cure; but this is not wholly to be laid to the charge of situation or distance from the source of the circulation, some portion of it is to be attributed to position, the legs being depending parts, and those parts which are most distinct happen also to be the most depending. We find an horizontal position assists in the repair of such parts, but even then they are not equal in their powers to parts situated above the chest; the difference therefore is principally to be attributed to situation, or distance from the heart. The same disease that showed the comparative powers between the muscle and tendon, shows also that they are equally affected by position; thus we see ulceration and mortification taking place in the lower extremity, as such, more readily, and with less powers of repair, than happens in parts near the chest.

This is still more the case if the person be tall. This is seen by changing a limb from a horizontal position, in which it was easy, to a dependent one, wherein it feels pain; because the new position increases the length of the column of blood in the veins. I am inclined to believe that the retardation of the cure is more owing to a stagnation of the blood in the veins, from the length of the column, than from a deficiency in the motion of the blood in the arteries. As the readiness of a part to fall into disease, and its backwardness to admit of cure, arises from position, it is in some degree compensated by rest and a change of the position.

These differences in the structure, situation, and position of parts in the body, make, I believe, but little difference in the progress of specific diseases: the venereal disease, however, certainly does not make such progress in bone, tendon, etc. as in the skin; nor does the cure advance so rapidly in those parts; but both these effects may be attributed to another cause, which is,

that bones and tendons are more deeply seated. I believe, however, that position makes no difference in the disease itself, although it may have some influence upon the power of cure, and perhaps in all specific diseases, in the progress towards a cure; for a venereal sore is always approaching nearer and nearer to the nature of a common sore, and therefore is more and more readily influenced by what influences a common sore. But in diseases for which there is at present no cure, as the cancer, I believe it makes no difference where it is situated, or in what it is placed, except in the case of such parts as have a tendency to such diseases, which no one of the parts above mentioned has more than another.

I have so far considered, in the general way, the comparative powers of different structures, of different situations, and of different positions in some parts of the body when affected by disease. Disease is the only circumstance which exposes these principles to our view; but to see how far the same principle was carried in natural operations, of which the most remarkable is the growth of parts, I made several experiments on fowls. The first was the common experiment of transplanting the spur of a young chicken from its leg to its comb, in which experiment I always found that the spur on the comb, when it took root, grew much faster and became much larger than that left on the leg. This I attributed to the greater power of action in the comb than in the leg, although they are pretty nearly at equal distances from the source of the circulation; but probably position also favoured it, as there was no stagnation in the veins of the head. In the power of producing such effects in disease, as well as in the growth of parts, I was then desirous to know the comparative degrees between the male and the female. I wished also to ascertain if the parts peculiar to the male could grow on the female, and if the parts of a female, on the contrary, would grow on a male.

Although I had formerly transplanted the testicles of a cock into the abdomen of a hen, and they had sometimes taken root there, but not frequently, and then had never come to perfection, yet the experiment could not, from this cause, answer fully the



intended purpose; there is, I believe, a natural reason to believe it could not, and the experiment was therefore disregarded. I took the spur from the leg of a chicken; it took root, the chicken grew to a hen, but at first no spur grew, while the spur that was left on the other leg of the cock grew as usual. This experiment I have repeated several times in the same summer, with the same effects, which led me to conceive that the spur of a cock would not grow upon a hen, and that they were, therefore, to be considered as distinct animals, having very distinct powers. In order to ascertain this, I took the spurs of hen chickens and placed them on the legs of young cocks. I found that those which took root grew nearly as fast, and to as large a size as the natural spur on the other leg, which appeared to be a contradiction to my other experiments. Upon another examination of my hens, however, I found that the spurs had grown considerably, although they had taken several years to do it; for I found that the same quantity of growth in the spur of a cock, while on the cock, during one year, was as much as that of the cock's spur on the hen in the course of three or four years, or as three or four to one; whereas the growth of the hen's spur on the cock was to that of the proper spur of the cock as (one to two?) two to one.

These experiments show that there is an inequality of powers in different parts of the same animal, and that the legs have much less than the comb; they also show that there is a material difference in the powers of the male and female. The spurs of a cock were found to possess powers beyond those of a hen, while at the same time, the one animal as a whole has more powers than the other; yet when I apply these principles to the powers of cure in local diseases of the two sexes in the human race, I can hardly say that I have observed any difference. It is to be observed, however, that women commonly live a much more temperate life than men, which certainly must have considerable influence both with regard to resisting and curing diseases.

In all complicated animals, among which man is the most complex, the parts are composed of different structures, and we find that in such animals the powers of action of those different structures within themselves are very different; when they are

therefore excited to any common action; the varieties produced should be well known and particularly attended to. Besides, every similar structure in different animals does not always act in the same manner. Thus we cannot make a horse vomit; nor can we give many specific diseases which attack the human subject to any other animal, more particularly the morbid poisons. The mode therefore of action in one animal does not implicitly direct to the mode of action in another; nor does the same structure in the same animal always act in the same way at all times: it acts at various times in a way similar to the same structure in various animals; and, besides, the same structure varies its action in different situations in the same animal. Besides, the exterior actions of life make a very material difference in the internal actions of animals, or in the excitement of disease, either universally or locally; for there are parts which cannot bear one mode of life, while there are other parts which cannot bear another,—parts and mode of life being in opposition with each other. A great many of these varieties depend upon the difference in the natural strength and weakness of the parts; but as those vary very considerably in different habits, so the varieties are increased; and likewise, as many occurrences in life produce the principle of strength or weakness, we have those varieties still more increased, as well as disease.

These observations, as heads, I shall treat more fully, but not as my principal subject, attending to them only so far as they are connected with inflammation and may illustrate the varieties in that action.

*1. Of the different Causes which increase and diminish the susceptibility for Inflammation either in the whole body or in parts*

Susceptibility for inflammation may be said to have two causes, the one original, the other acquired. The original constitutes a part of the animal œconomy, and is probably inexplicable. Of the acquired it is probable that climate and modes of life may tend considerably either to diminish or increase the susceptibility for inflammation.

The influence, however, of climate may not be so great as it commonly appears to be, for it is generally accompanied by modes of life that are not suited to others; and if we consider how much less pernicious many climates are now than they were formerly, arising from the mode of living being different, we may be led to allow less influence to climate; and, on the other hand, if we consider how diseases become multiplied and varied in the same climate, we shall see that climate alone is not attended with so much variety as may have been supposed. It is observed by some of the ablest physicians of this day that the fever called inflammatory is now not so common in this country as it was formerly represented to have been; that it is now seldom that in fevers they are obliged to have recourse to the lancet, at least to that excess which is described by authors in former times. They are now more obliged to have recourse to cordials than evacuations, and indeed the disease called putrid fever and putrid sore throat are but of late date. I remember when the last was called Fothergill's sore throat, because he first published upon it and altered the mode of practice. I remember when practitioners uniformly bled in putrid fevers; but signs of debility and want of success made them alter their practice.

Whether the same difference takes place in inflammation I do not know, but I suspect that it does in some degree, for I am inclined to believe that fever and inflammation are very nearly allied, that is, that either will be according to the constitution, which is not the case with specific diseases, excepting in their common modes of action, which consist either in fever or inflammation; but I believe we have much less occasion for evacuations in inflammation than there was formerly; the lancet therefore in inflammation, and also purgatives, are much more laid aside. How far climate varies the constitution, so as to alter the nature of diseases, I do not at present know; but it would appear from Dr. Blane's account that inflammation is hardly a disease in the West Indies.

How far an alteration in the mode of life is the cause of this difference I will not pretend to say, but certainly the way of life is very much altered. We certainly live now more fully than

what they did formerly: we may be said to live above par. At the full stretch of living, therefore, when disease attacks us, our powers cannot be excited further, and we sink, so as to require being supported and kept up to that mode of life to which we have been accustomed.

A kind of constant state and variety of mind may often alter constitutions so much as to alter the mode of diseased action, which is much more common in some countries than others. We may be pretty certain that this state of mind often produces the inflammation of the gout.

Probably there is but little power in art to correct the susceptibility of inflammation; however, if the susceptibility of the body be similar to that of the mind it ought to be in some degree corrected by art. The mind is corrected by reason, together with habit, but the body can only have the last employed upon it: it might be made less susceptible by the immediate causes coming slowly upon it, or by avoiding those causes, and even acting in diametrical opposition to them. This will at least answer in the acquired susceptibilities. The acquired susceptibility for inflammation, or indeed for any other disease as it is acquired by art or habit, may be lessened simply by a cessation of those habits; and if the habit is of any particular kind, which is always ascertainable, then the habit of the contrary is to be used, which must also be ascertainable.

Strength and weakness are the opposites of each other, and therefore must have very different effects in disease. They have very different powers in resisting disease, in their mode of action, and also in their readiness to terminate that action. Strength, probably, under every circumstance, produces good effects, or at least it is always more in the power of management by art than weakness. I can conceive, however, that too much strength might act with too much power, becoming unmanageable under disease that excites action.

In inflammation when the constitution is strong then it will be commonly the most manageable, for strength lessens irritability. But in every kind of constitution inflammation will be the most manageable where the power and the action are pretty

well proportioned; but as every part of the body has not equal strength, these proportions cannot be the same in every part of the same constitution. According to this idea of strength, the following parts, viz. muscles, cellular membrane, and skin, and more so in proportion as they are nearer to the source of the circulation, will be most manageable in inflammation and its consequences, because they are stronger in their powers of action than the other parts of the body. The other parts, as bone, tendon, ligament, &c., fall into an inflammation which is less in the power of art to manage, because, though the constitution is good, yet they have less powers within themselves, and therefore are attended with the feeling of their own weakness; and I believe they affect the constitution more readily than the former, because the constitution is more affected by local disease when the parts have less power within themselves of doing well, and the effects, if bad, on the constitution reflect a backwardness on the little powers they have. Strength and weakness of the constitution, or of parts, are synonymous terms with a greater or less quantity of animal life, or living principle joined with powers of action.

The inflammation, if in vital parts, will be still less manageable; for although the parts themselves may have pretty strong powers, yet the constitution, and the natural operations of universal health, become so much affected that no salutary effect can so readily take place, and therefore the disease becomes less manageable. If the vital part is the stomach, or such as the stomach readily sympathises with, inflammation in such parts will be still less manageable, for no operation can go on well, either in the stomach, or in other parts where this viscus is affected, as the powers of restoration become weaker than ever.

In weak constitutions, although the inflammation be in parts which admit of the most salutary operations in the time of disease, and in situations the most favourable to restoration after disease, yet the operations of inflammation are proportionably more backward as to their salutary effects in such constitutions, and more or less according to the nature of the parts affected, which I shall now consider more fully.

2. *Effects of strength or weakness of Constitution, and of Parts, while under Inflammation*

Whatever is to be the consequence of injuries, especially inflammation, is produced much more readily in a strong constitution than in a weak one. A wound, for instance, made upon a person of a healthy constitution and sound parts will unite almost at once: it admits readily of a union by the first intention. A greater strength of constitution and of parts admits of resolution, while in the adhesive state of inflammation, very readily, and therefore tends much to prevent the suppurative inflammation from taking place, for it gives a better disposition to heal by the adhesive; so that the union of parts by the first intention, the inflammation and resolution, as well as the readiness to change from the one to the other, according as the preceding is prevented, depends equally upon the strength and health of the constitution and parts inflamed. We may also observe that a greater strength and soundness of the constitution or parts inflamed, when the inflammation has got beyond the stage of resolution and has assumed the disposition for suppuration, hastens on inflammation and suppuration, and also brings it soon to a termination, while at the same time the matter is brought more quickly to the skin by ulceration. Whatever therefore is the step which nature is to take, whenever an injury is done or a necessity for inflammation has taken place, it is performed with readiness and facility in strong constitutions and parts.

Weakness of constitution and weakness of parts are supposed to be the immediate cause of most tedious or chronic diseases. It appears to be often used as a general term, as have also nervous, bilious, to denote anything for which we cannot well account, and to which I am certain there has been affixed no precise meaning. Every action that is not acute, especially a mild continuation of some of the symptoms of a former violent disease, is called weakness. Thus a gleet is called a weakness, fluor albus is called a weakness, diarrhoea is called a weakness: none of which I conceive simply to arise from weakness, for I believe that weakness seldom or never becomes an immediate cause of disease or action

of any kind; but it often becomes the predisposing cause of disease, many diseases not taking place except where weakness is an attendant, as agues, scrofula, nervous, &c., none of which are simple weakness; and it may continue many diseases when they have already taken place. This is, I think, very evident in many diseases which would terminate well if there was strength in the constitution to perform the right actions. However, where there is a strong susceptibility for any one disease, in which weakness might also become a predisposing cause, I can believe that in such cases weakness, especially if suddenly brought on, may become an immediate cause of that disease: as, for instance, a man may, from a wound or any other cause, have a strong tendency to a locked jaw. If you bleed that man freely it is a thousand to one but that a locked jaw comes on: weakness produces a consciousness of its own want of powers, or incapacity, which produces increased action, that even proceeds the length of unnatural actions, called nervous. These effects are no less visible in acute diseases in such constitutions, which include accidents or violence of all kinds; for they run into too violent action which is not of a salutary kind, and therefore may be called unnatural diseased action.

When a wound is made in a person of a weak habit there is a great backwardness in the two cut surfaces to unite by the first intention, therefore inflammation takes place if there be strength of constitution to produce it, which is not always the case, so that in such habits inflammation is more likely to be a consequence; but this does not arise from a greater readiness to inflammation in the habit, but from a want of power and disposition to heal, which renders inflammation necessary. However, in this case the want of powers or disposition to unite may partly depend upon a different principle from that of weak parts or solids: it is probable that the blood of people of weak habits is weak in its living principle, which it therefore very soon loses upon extravasation, so as to become unfit for a bond of union, by which it degenerates into an extraneous body, and therefore the suppurative inflammation must take place if there be strength to produce it.

In weak habits and diseased parts inflammation is slow in any of its salutary effects, and is hardly capable of either producing the adhesive or suppurative inflammation. If they should take place, it is but imperfectly, and the inflamed parts surrounding the suppurative surfaces are hardly capable of resolution, but continue inflamed; we even find in many constitutions, where the animal powers are very much weakened, that, instead of their readily running into inflammation, it is hardly possible to promote it even from a breach of continuity in the solids, which in most other cases is surest of being followed by inflammation: such constitutions are in general those which are dropsical. I have seen several cases where the power has been so weak that the wound, after tapping, has not united by the first intention, nor has even acquired the adhesive state of inflammation, and has admitted water to pass through it from the abdomen for several weeks without the peritoneal inflammation being excited. In the same dropsical habits I have seen scarifications in the legs or feet not inflame, so that the cells were not united but continued to discharge the water for many weeks. In such cases of extreme weakness this total want of inflammation would appear to be a salutary effect; for in many dropsical cases, where the parts have powers to inflame, but not sufficient to go through the different stages of the inflammation, and at last resolve as in healthy constitutions, the inflammation generally produces a total loss of animal powers and the part mortifies, which often produces death in the whole, so that in such cases the parts only act to destroy themselves. As a further proof that debility is often the cause of increased inflammation, in consequence of any violence, and often the cause of mortification, is plainly shown in Mr. Dick's account of dropsies among the troops in the East Indies. (*Duncan's Edin. Med. Com.*, x 207.) In the first year of the attack in any man he durst not venture to scarify the legs; but when they were attacked with the same disease the year following, which was often the case, whenever he attempted to scarify the legs a violent inflammation and mortification were the consequence. He was in this second attack obliged to have recourse to strengtheners; and we may observe that, in the case of tapping, if the constitu-



tion is irritable, the cavity of the abdomen commonly feels the effect, and inflammation of the peritoneum, and death is the consequence.

As the effect which this inflammation has upon the constitution is by sympathy, it must be in proportion to the readiness with which the constitution assumes that action. This susceptibility is stronger in some constitutions than in others; and every constitution is more susceptible of sympathy with some parts of the body than with others. The kind of constitution which is least affected by this inflammation is that which is in general most healthy, where sympathy hardly takes place. This happens to be the case with such constitutions as can most readily perform all the different operations with ease; and when the parts inflamed are able to manage their own business they thereby affect the constitution less; for we shall find that a constitution may be affected by a local disease merely because it is beyond the power of the part to cure itself.

But it is to be observed that constitutions in full vigour, or which have not been in the smallest degree accustomed to local disease, take the alarm much more readily than those which are not in such full health, or which have been accustomed to local disease. Thus, if a man in perfect health gets a very bad compound fracture in the leg, or has his leg taken off, either for this fracture or in consequence of any other accident, he stands a much worse chance of recovery than one who has been accustomed to a local disease. Even the man with the compound fracture will do much better if his leg is not taken off till the first symptoms are over; or at least we may be certain that the symptoms arising from the amputation will not be nearly so great as those that arise at first from the fracture, or would have arisen from the immediate amputation. This would appear to be a contradiction to the above position; but, upon an accurate investigation, I think it may be accounted for; for, first, I do not look upon full health as the best condition to resist disease. Disease is a state of body which requires a medium: health brooks disease ill, and full health is often above par; persons in full health are too often at the full stretch of action, and cannot bear an increase, especially

when diseased; and, as I before observed, it is a new impression on the constitution, and till it be in some degree accustomed to local disease it is less able to bear such as is violent; besides, the removal of a diseased part which the constitution has been accustomed to, and which is rather fretting the constitution, is adding less violence than the removal of a sound part in perfect harmony with the constitution; the difference, however, is not wholly owing to that cause, for the circumstance of a constitution being accustomed to a mode of life, &c. which it is to continue, makes a considerable difference.

*3. Of Parts of the Body most susceptible of the three different Inflammations to be treated of*

All parts of the body are susceptible of inflammation, although not all equally so; nor will all parts of the body admit readily of the three different kinds of inflammation I mean to treat of, some parts admitting readily of one only, others of two, and others of all three; which difference appears to be according to the situation of the inflamed parts in the body, and also the nature of the parts inflamed.

The cellular membrane the first. The cellular membrane free from the adipose appears to be more susceptible of the adhesive inflammation than the adipose membrane, and much more readily passes into the suppurative. Whether this arises from surfaces inflaming more readily than other parts I will not pretend to say. Thus we see that the cellular membrane connecting parts together as muscles, and the cellular membrane connecting the adipose to muscles, easily inflames and runs readily into suppuration, and as it were separates the muscles from their lateral connection, and even separates the adipose from the muscles, while the skin and adipose membrane shall only be highly inflamed, and the matter so formed must produce ulceration through all this adipose membrane to get to the skin, and then through the skin, in which last mentioned parts it is much more tedious; ulceration therefore does not so readily take place in those parts as it does in the common connecting membrane. Muscles, nerves, and blood-vessels are parts which

nature wishes to retain, and the adipose membrane contains a substance which is properly no part of the animal, viz. oil: it may therefore be more difficult for this part to be absorbed than what are properly the parts of the animal itself.

As a deficiency in the power to heal becomes a stimulus or an incitement to inflammation, we find that similar parts, in proportion as they are removed from the source of the circulation, such as the lower extremities, are more ready to inflame than others not so circumstanced; and what adds to this backwardness is their being depending parts, which adds to the incitement.

The deeper-seated parts of the body, and more especially the vital, very readily admit of the adhesive inflammation, which is proved by dissections; for we hardly ever open a human subject where there are not in the circumscribed cavities considerable adhesions; and most probably many in the common cellular membrane, if they were equally visible. The deeper-seated parts, however, do not in common so readily pass into the suppurative inflammation; and this readiness to accept of the adhesive most probably becomes a cause why the suppurative inflammation does not so readily take place. But if the inflammation comes on at once, with great violence, it would appear to pass almost at once over the adhesive immediately to the suppurative action; or perhaps where it may appear to have done this there may be an erysipelatous disposition; for although it is not the disposition of the erysipelatous inflammation to suppurate, yet it has a greater backwardness to produce adhesions. This effect we often find takes place in the abdomen, in the thorax, &c., and I have already mentioned that I suspect the erysipelatous inflammation does, in some degree, reverse the common rules of the common inflammation, by being more ready to suppurate in deep-seated parts than in the superficial, and extend much further towards the centre of the body. I suspect too that the coverings of the brain, viz. pia and dura mater, have something of this disposition. They appear to suppurate very readily, or with very little inflammation; for from a slight blow on the head we find these membranes much oftener suppurate than we should from a similar blow on the shin-bone: for instance, a blow on this bone will only

produce suppuration on the external surface, very seldom in its internal cavity; but a blow on the head that shall not even produce the adhesive inflammation in the scalp shall make those membranes suppurate.

Inflammation, wherever situated, is always more violent on that side of the point of inflammation next to the external surface. This effect we often find takes place in the abdomen, in the thorax, &c., and I have already mentioned that I suspect inflammation, wherever situated, if there be a continuity of parts between it and the external surface, will be greater on that side next to the external surface of the part than towards the centre of the part. This also equally takes place in inflammation, although close to the different outlets of the body, and is probably most easily demonstrated in them. Thus, for instance, if an inflammation comes on in the socket of a tooth at its root, inflammation will not take place on the inside of the jaw, but towards the outside; and if it is beyond the union of the lips with the gum it will attack the skin over the inflamed part, while all the internal parts, such as the gums on both sides, but principally on the inside and tongue, if in the lower jaw, shall be perfectly sound.

If an inflammation attacks the cellular membrane on the outside of the gut near the anus, although the gut is in contact with the inflamed part, yet the inflammation extends to the skin of the buttock, while the gut remains pretty free from inflammation.

If an inflammation attacks the peritonaeum covering an intestine, and if adhesions between it and the peritonaeum lining the abdomen are a consequence, the inflammation immediately passes through the abdominal muscles towards the skin, while the proper coats of the intestines shall in most cases remain sound; however, this is not always the case, although much more commonly so than the reverse. We see the same thing in the obstruction of the natural passage of the tears, called fistula lacrymalis, for there the sac and skin ulcerate on the inner angle of the eye, while the inside of the nose defends itself by becoming thicker, so much so in many cases as to stop the cavity of the nose and unite with the septum, which has been the cause of the

failure of the operations for the fistula lacrymalis. We even find that if an abscess forms in a frontal sinus from an obstruction in its duct that the matter makes its way through the frontal bone externally, instead of getting into the nose. The same observations are applicable to abscesses in the antrum, which are common cases; and indeed, if we observe accurately, we shall find that nature rather defends such parts as are either deeper seated or on the inside of outlets, as will be explained hereafter.

The specific qualities in diseases also tend more rapidly to the skin than to the deeper-seated parts, except the cancer; although even in this disease the progress towards the superficies is more quick than its progress towards the centre. The venereal has something of the same disposition with cancer, although not so much. In short, this is a law in nature, and it probably is upon the same principle by which vegetables always approach the surface of the earth.

That this is a general principle in vegetation requires no illustration, but what is the immediate cause is not so easily determined. I conceived it might be the light, not warmth, for the ground is often warmer than the air or surface into which vegetables are often growing. To ascertain this as far as I could by experiment, I took a tub, about eighteen inches deep, and about two wide, and filled it with fine mould, in which I planted some beans and peas; their eyes were placed in various directions, and over the surface was spread a close-meshed net. The mouth of this tub was turned down, was raised about three feet from the ground, and was suspended between two posts. Round the tub, and over its bottom, which was uppermost, were placed wet straw, mats, &c. to take off any influence the sun or air might have upon its contents, and a small hole was bored in its bottom, to which was fixed a small long tube that came through the straw. This was intended for pouring some water, if I found the earth got dry, into the tub. Under the mouth of the tub I placed looking-glasses, in such a way that the light was thrown upon the mouth of the tub, or surface of the earth. The weather was fine, so that through the whole day there was the reflection of the light from the looking-glasses upon the surface of the mould,

which was much more powerful than daylight without the direct rays of the sun. This I continued till I conceived that the beans and peas had grown some length, but not finding their tops coming down through the surface of the mould, I examined the contents of the tub, and found that they had all grown upwards towards the bottom of the tub, and that in those whose eyes had been placed downwards the young shoot had turned round so as to arise up.

As one experiment leads to another, I wished to see how a bean would grow if kept in a constant rotatory motion. For this purpose I put some earth in a basket, having the shape of a cylinder, and about a foot diameter, with the two ends of wood for greater strength, through the centre of which I fixed an axis or spindle; in this earth I planted a bean, about half way between the surface and axis, with its eye to the surface. The basket was laid across the mouth of a large tub, with the ends of the spindle resting on the edges of the tub, which were fitted to one another so as to allow of easy motion. Round the basket was rolled some small cord, to the end of which was suspended a box, water tight; into this was put lead, so as almost to make it sink in water, and which was sufficient to turn the basket round in the open air. This large tub was filled with water, and the box placed upon it, and the spindle with the basket placed across the mouth of the tub; a very small hole was bored at the lower end of the tub, which allowed the water to escape, but very slowly; as the water sunk in the tub the box descended, and as the box descended the basket was turned round. This tub took about twelve hours in emptying, and during that time the spindle with the basket only turned about one and a half. The tub was repeatedly filled, and when I conceived the bean might have grown some inches, if it had grown at all, I examined it, and found it had grown as much as if it had been planted in the common ground, but it had no particular direction but that of passing in a straight line from the bean, which was at first towards the circumference, the direction in which it was planted; but in its course it had met with a small stone, which had turned it into the direction of the axis, and it had gone on in a straight line in that

direction. Here, as there was no fixed inducement to grow in any one direction, the bean grew in a straight line, in that direction given it by chance.

This circumstance of the deeper-seated parts not so readily taking on the suppurative inflammation as those which are superficial, is shown in cases where extraneous bodies irritate any parts; for we find that extraneous bodies are in general capable of producing inflammation, but if these extraneous bodies are deeply seated, they may remain for years without doing more than producing the adhesive inflammation, by which means they are inclosed in a cyst, and only give some uneasiness; or if they are such as can be made to change their situation by the actions of the body upon them, as pins and needles, or from gravity, as is the case sometimes with bullets, then the parts through which they pass seem not to be much altered or disturbed; but if the same body was nearer to the skin it would produce suppuration. This is proved by the cases that have occurred of people swallowing pins, needles, etc.: they have been found to travel almost over the whole body, without producing any effect, except in some situations exciting some sensation; but when they have come near to the skin, the very same substance has generally produced suppuration.

This principle shows itself very remarkably in the cattle which feed in bleaching fields; there is not one of these killed without having their stomachs, etc. stuck full of pins, and no seeming inconvenience takes place, for they appear to be healthy, and fatten as readily as other cattle. However, it is to be remarked that these pins are not found in the fourth or digesting stomach, therefore do not give that disturbance to the constitution that might be expected. It is probable that these cases of pins, etc. owe their want of power in producing suppuration, not entirely to situation but in some degree to the nature of the substance, metals perhaps not having the power of irritation beyond the adhesive, for when the adhesive has taken place the part appears to be satisfied. This appears also to be the case with the introduction of glass, even in superficial parts: a piece of glass shall enter the skin just deep enough to bury itself; inflammation shall

come on; the wound in the skin, if brought together, shall heal by the first intention; and the inflammation shall not exceed the adhesive, but rather degenerate into the disposition for forming a sac, by which means a sac is formed round the glass, and no disturbance is given to the irritability of the parts. This was the case with Mr. Knight, apothecary, who had a piece of glass three fourths of an inch long run into the palm of his hand, and remained there for ten weeks, without any further inconvenience than retarding the motion of the hand, and sometimes giving a pricking pain, when the sac was made to press upon the points of the glass; this insensibility, however, arises from a sac being formed with such properties, but it cannot be assigned as a cause in the case of bodies moving as pins.

Whether this fact, of external parts assuming the suppurative inflammation more readily than the internal, arises from unknown properties in the parts themselves, or from circumstances which attend situation, such as heat, cold, etc., is not easily determined; but whatever be the cause, the effects are good, as many situations of inflammation, viz. the internal, would prove dangerous if the parts were always, or often to suppurate; of two evils, nature chooses the least; while, on the other hand, when near the external surface, it becomes the least evil to produce suppuration, in order to get rid of the extraneous matter. Accidents may be assigned as one cause of this frequency upon the external surfaces, but the cases of pins above mentioned (which is accident), show, that even when it arises from accident, the parts near the external surface much more readily suppurate; and in all cases arising from the constitution, or spontaneous, the external inflammations exceed the internal in number, violence, and extent.

## PART II

### CHAPTER III

#### THE ADHESIVE INFLAMMATION

I shall begin by treating of the nature and effects of what I have called the adhesive inflammation, as well as giving a proper idea of it. I shall also open the way to a clear understanding of



the many phenomena which attend the suppurative inflammation. But as inflammation does not produce one effect only, but several, and as most of them take place about the same time, it is difficult to determine in the mind which to describe first.

Inflammation in most cases appears to begin at a point: for at the very first commencement all the local symptoms are within a very small compass; and they afterwards spread according to the violence of the cause, the disposition in the parts for inflammation, and the nature of the surrounding parts themselves, which susceptibility in the surrounding parts may be either constitutional or local. This is so much the case that inflammation shall come on at once in a fixed point, giving great pain, and which shall be soon followed by tumefaction. This is also the case with those inflammations which arise from accident, for all accidents are confined to fixed and determined limits; but the inflammation which follows is not; it spreads over a large extent; yet the inflammation is always the greater the nearer it is to the first fixed point, and gradually becomes less and less in the surrounding parts, till at last it is insensibly lost in them.

This spreading of the inflammation is owing to continued sympathy, the surrounding parts sympathizing with the point of irritation; and in proportion to the health of the surrounding parts and constitution this sympathy is less; for we find in many states of parts, and many constitutions, that there is a disposition to this sympathy, and in such the inflammation spreads in proportion.

### *1. Action of the Vessels in Inflammation*

The act of inflammation would appear to be an increased action of the vessels; but whatever action it is, it takes place most probably in the smaller vessels, for it may be confined almost to a point where nothing but the smallest vessels exist. The larger vessels may be considered as only the conveyers of the materials, for the smaller to act upon and dispose of according to the different intentions; however, inflammation in a part is not only an action of the smaller vessels in the part itself, but in the larger vessels leading to it. This is proved by a whitlow taking place on the end of a finger; for although the inflammation itself shall

be confined to the end of a finger, and the inflammatory sensation or throbbing be situated in this part, yet we can feel by our hands, when we grasp the finger, a strong pulsation in the two arteries leading to the inflamed part, while no such pulsation can be felt in the other fingers; and if the inflammation is very considerable, the artery, as high as the wrist, will be sensibly affected, which proves that the arterial system is at that time dilating itself, and allowing a much larger quantity of blood to pass than is usual. This is probably by continued sympathy.

Where the inflammation affects the constitution, the vessels of the system rather contract, and keep as it were stationary, which stationary contraction is more or less according to the state of the constitution. In strong healthy constitutions, whose powers are equal to the necessary actions, or in parts that affect the constitution less, this contraction is less and less stationary.

The very first act of the vessels when the stimulus which excites inflammation is applied, is, I believe, exactly similar to a blush. It is, I believe, simply an increase or distension beyond their natural size. This effect we see takes place upon many occasions: gentle friction on the skin produces it, gently stimulating medicines have the same effect; a warm glow is the consequence, similar to that of the cheek in a blush; and if either of these be increased or continued, real inflammation will be the consequence, as well as excoriation, suppuration, and ulceration. This effect we often see, even where considerable mischief has been done; and I believe it is what always terminates the boundaries of the true inflammation. A musket-ball shall pass a considerable way under the skin, perhaps a half-way round the body, which shall be discovered and traced by a red band in the skin, not in the least hard, only a little tender to the touch; and it shall subside without extending further. This appearance I shall term a blush; for although this may be reckoned the first act of inflammation, yet I would not call it inflammation, having produced a lasting effect. I should rather say that inflammation sets out from this point, and that afterwards a new action begins, which is probably first a separation of the coagulating lymph, and the throwing it out of the vessels.

The parts inflamed appear to become more vascular; but how

far they are really so I am not certain; for this appearance does (at least in part) arise from the dilatation of the vessels, which allows the red part of the blood to go into vessels where only serum and coagulating lymph could pass when they were in a natural state; and till the newly-extravasated substances become vascular, the effect is most probably owing wholly to the above cause.

This incipient enlargement of the vessels upon the first excitement of inflammation is satisfactorily seen in the following manner. Make an incision through the skin on the inside of the upper part of a dog's thigh, three inches long. By pulling the cut edges asunder, and observing the exposed surface, we shall see the blush or ash-coloured cellular membrane covering the different parts underneath, with a few arteries passing through it to the neighbouring parts. But in a little time we shall see these vessels increasing in size, and also smaller vessels going off from them that were not before observable, as if newly formed or forming; the number and size shall increase till the whole surface shall become extremely vascular, and at last the red blood shall be thrown out in small dots on the exposed surface, probably through the cut ends of the arteries that only carried the lymph before. This surface will become in time more opake and less ductile. Parts inflamed, when compared with similar parts not inflamed, show a considerable difference in the size of the vessels, and probably from this cause bring an increased number to view. I froze the ear of a rabbit and thawed it again: this excited a considerable inflammation, an increased heat, and a considerable thickening of the part. This rabbit was killed when the ear was in the height of inflammation, and the head being injected, the two ears were removed and dried (see Pl. XX.). The uninflamed ear dried clear and transparent, the vessels were distinctly seen ramifying through the substance; but the inflamed ear dried thicker and more opake, and its arteries were considerably larger.

In inflammation of the eye, which is commonly of the tunica conjunctiva, the progress of inflammation may in part be accurately observed, although not so progressively as in a wound. The contrast between the red vessel and the white of the eye, under this coat, is very conspicuous; and although we do not see

the vessels enlarging in this coat, yet we see the progress they have made: the white appears as if it was becoming more vascular, and these vessels larger, till at last the whole tunica conjunctiva shall appear as one mass of blood, looking more like extravasated blood than a congeries of vessels, although I believe it is commonly the last.

From these circumstances it must appear that a much larger quantity of blood passes through parts when inflamed than when in a natural state, which is according to the common rules of the animal œconomy; for, whenever a part has more to do than simply to support itself, the blood is there collected in larger quantity. This we find to take place universally in those parts whose powers are called up to action by some necessary operation to be performed, whether natural or diseased.

As the vessels become larger, and the part becomes more of the colour of the blood, it is to be supposed there is more blood in the part; and as the true inflammatory colour is scarlet, or that colour which the blood has when in the arteries, one would from hence conclude either that the arteries were principally dilated, or at least, if the veins are equally distended, that the blood undergoes no change in such inflammation in its passage from the arteries into the veins, which I think is most probably the case; and this may arise from the quickness of its passage through those vessels.

When inflammation takes place in parts that have a degree of transparency, that transparency is lessened. This is, probably, best seen in membranes, such as those membranes which line cavities, or cover bodies in those cavities, such as the pia mater, where, in a natural state, we may observe the blood-vessels to be very distinct. But when we see the blood-vessels fuller than common, yet distinct in such membranes, we are not to call that inflammation, although it may be the first step, as we find to be the case in the first action of the vessels in consequence of such irritation as will end in inflammation. As it may not, however, be the first step, there must be other attending circumstances to determine it to be the very first action of the vessels in inflammation, for as that appearance may either belong to a

briskness in the circulation in the part at the time, or be the very first step in inflammation, their causes are to be discriminated by some other symptom. They are both a kind of blush, or an exertion of the action of the vessels; but when it is an effect of an inflammatory cause, it is then only that the inflammation has not yet produced any change in the natural structure of the parts, but which it will soon do. What the action is, or in what it differs from the common action of the vessels, is not easily ascertained, since we are more able to judge of the effects than the immediate cause. However, it is probably an action of the vessels, which we can better observe than any diseased action in the body, for we can observe the state in which the arteries are, with their general effects; we feel also a different temperature respecting heat, yet the immediate cause may not be ascertainable.

The vessels, both arteries and veins, in the inflamed part are enlarged, and the part becomes visibly more vascular; from which we should suspect, that instead of an increased contraction, there was rather what would appear an increased relaxation of their muscular powers, being, as we might suppose, left to the elasticity entirely. This would be reducing them to a state of paralysis simply; but the power of muscular contraction would seem to give way in inflammation, for they certainly dilate more in inflammation than the extent of the elastic power would allow: and it must also be supposed that the elastic power of the artery must be dilated in the same proportion. The contents of the circulation being thrown out upon such occasions, would, from considering it in those lights, rather confirm us in that opinion; and when we consider the whole of this as a necessary operation of nature, we must suppose it something more than simply a common relaxation; we must suppose it an action in the parts to produce an increase of size to answer particular purposes; and this I should call the action of dilatation, as we see the uterus increase in size in the time of uterine-gestation, as well as the os tincae in the time of labour, the consequence of the preceding actions, and necessary for the completion of those which are to follow.

The force of the circulation would seem to have some share in

this effect, but only as a secondary cause; for I could conceive a part to inflame, or be in a state of inflammation, although no blood were to pass. As a proof of this, we may observe, that by lessening either the action of the heart, or the column of blood, inflammation is lessened; and I may also observe, that we have an increased pain in the inflamed part in the diastole of the artery, and a part inflamed by being gently pressed is made easier. Thus a person with an inflammation in the finger will find relief by gently pressing it in the other hand. These are strong proofs that it is not a contractile action of the muscular coat of the vessel; for in such a sensible state of vessels, if they contracted by their muscular power, the pain would be in their systole; for we find in all muscles which are in a state of great sensibility, from whatever cause, that they cannot act without giving great pain. Thus an inflamed bladder becomes extremely painful when expelling its contents; an inflamed intestine in the same manner. I should say, therefore, that in inflammation the muscular coats of the arteries do not contract.

Whatever purpose this increase of the size of the vessels may answer, we must suppose it allows a greater quantity of blood to pass through the inflamed part than in the natural state, which supposition is supported by many other observations. The part inflamed, I have already observed, becomes to appearance more vascular than when in the natural state, and it is probable that it is really so, both from new vessels being set up in the inflamed part, as well as from the new and adventitious uniting substance becoming vascular. Besides, the vessels of the parts are enlarged, so that the red blood passes further than common, which increases those appearances. But the brain appears to be an exception to these general rules; for in all diseases of the brain, where the effects were such as are commonly the consequence of inflammation, such as suppuration from accidents, I never could find the above appearances; the brain may, perhaps, go directly into suppuration, as sometimes the peritonaeum does; but its slowness of going into suppuration after the accident would make us suppose, *a priori*, that there was sufficient time for adhesions to form.

*2. Of the Colour, Swelling, and Pain of Inflamed Parts*

(*Colour.*)—The colour of an inflamed part is visibly changed from the natural, whatever it was, to a red. This red is of various hues, according to the nature of the inflammation; if healthy, it is a pale red; if less healthy, the colour will be darker, more of a purple, and so on till it shall be a bluish purple, which I took notice of in the short sketch of the peculiar inflammations; but the parts inflamed will in every constitution be more of the healthy red when near to the source of the circulation, than when far from it. This increase of red appears to arise from two causes; the first is a dilatation of the vessels, whereby a greater quantity of blood is allowed to pass into those vessels which only admitted serum or lymph before. The second is owing probably to new vessels being set up in the extravasated uniting coagulating lymph. This colour is gradually lost in the surrounding parts if the inflammation is of the healthy kind, but in many others it has a determined edge, as in the true erysipelatous, and in some specific diseases, as in the smallpox, where its quick termination is a sign of health.

(*Swelling.*)—From the account I have given of the immediate effects of inflammation of the cellular membrane (in which I include the larger cavities), the volume of the part inflamed must be increased. This, when a common consequence of inflammation, is not circumscribed, but rather diffused. As the inflammation, however, begins in a circumscribed part (which is at least the case with that arising from violence), the inflammation, as I just now observed, is always the greatest nearest to that point, and is gradually lost in the surrounding parts, the swelling of course being the greatest at or nearest to this point, and it is also lost in the surrounding sound parts. This takes place, more or less, according to the constitution, or the situation of the inflammation; for if the constitution be strong and healthy, the surrounding parts will sympathize less with the point of irritation, so that inflammation and its consequences, viz. extravasation, will be less diffused. There will be less of the serum, and of course a purer coagulating lymph, so that the swelled parts will be firmer; but in some specific diseases or dissimilar parts, as a

gland, it has a more determined edge, the surrounding parts not so readily taking on specific diseased action as in other cases. In this both the colour and swelling correspond very much, since they both depend on the same principle.

This increase of volume is owing to the extravasation of the coagulating lymph and some serum. In proportion to the inflammation (the degree of which depends on the causes above mentioned), this effect is more or less, and therefore is greatest at the point of inflammation, becoming less and less as it extends into the surrounding parts, till it is insensibly lost in them.

The extravasation of the serum along with the coagulating lymph is, probably, not a separation of itself, as in a dropsy, but a part of it being separated from the lymph in the coagulation of that fluid, is squeezed into the surrounding cellular membrane, where there is but little extravasation, and where the cells are not united by it. Thus the circumference of such swellings is a little oedematous; but the whole of the serum, if there be a depending part, will move thither, and distend it considerably, as in the foot in consequence of an inflammation in the leg. But in most cases there is a continued extravasation of serum, long after the extravasation of the coagulating lymph is at an end; so that depending parts will continue oedematous while the inflammation is resolving, or while suppuration, or even healing is going on. The whole swelling looks like a part of the body only a little changed, without any appearance of containing extraneous matter; and indeed it is simply formed by an extravasation of fluids without their having undergone any visible or material change, except coagulation.

(*Pain.*)—As few uncommon operations can go on in an animal body without affecting the sensations, and as the first principle of sensation arises from some uncommon action, or alteration being made in the natural position or arrangement of the parts, we should naturally suppose that the sensation would be in some degree according to those effects, and the sensibility of the parts. One can easily form an idea of an alteration in the structure of parts giving sensation which may even be carried to pain, but that the simple action of parts should produce sensations and



even violent pain is but little known, or at least has been, I believe, but little attended to; all these effects, I think, may justly be included under the term spasm; at least we are led by analogy to suppose that they belong to that class.

By spasm I should understand a contraction of a muscle without the leading and natural causes. Thus, the contraction of a muscle of the leg, called the cramp, gives considerable pain, often violent; as also the tetanus; and when in a less degree, as in the twinkling of the eyelid, it gives only sensation, whereas if the muscles were to act by ther will no sensation would be produced.

We find that those sensations are more or less acute, according to the quickness or slowness of the progress of these causes; from whence we are naturally led to assign two causes, which must always attend one another; for when both do not take place at the same time, the mind then remains insensible to the alteration. This is its being produced in a given time, for the alteration in the position of the parts may be produced so slowly as not to keep pace with sensation, which is the case when many indolent tumours, ascites, etc.; on the other hand, this alteration in the natural position of parts may be so quick as to exceed sensation, and therefore there is a certain medium, which produces the greatest pain.

The actions I have been describing being pretty quick in their effects, we cannot fail to see why the pain from the inflammation must be considerable; however, the pain is not the same in all the different stages. In the adhesive state of the inflammation it is generally but very inconsiderable, especially if it is to go no further, and is perhaps more of a heavy than an acute pain; when it happens on the skin it often begins with an itching, but as the inflammation is passing from the adhesive to the suppurative, the parts then undergo a greater change than before, and the pain grows more and more acute, till it becomes very considerable. The nerves also acquire at that time a degree of sensibility, which renders them much more susceptible of impression than when they are in their natural state; thus, an inflamed part is not only painful in itself, but it communicates impressions to the mind independent of pain, which do not arise from a natural sound

part. This pain increases every time the arteries are dilated, whence it would appear that the arteries do not contract by their muscular power in their systole, for if they did, we might expect a considerable pain in that action, which would be at the full of the pulse. Whether this pain arises from the distension of the artery by the force of the heart, or whether it arises from the action of distension from the force of the artery itself, is not easily determined. We know that diseased muscles give much pain in their contraction, perhaps more than they do when stretched.

That the degree of inflammation which becomes the cause of adhesions gives but little pain, is proved from the dissections of dead bodies, for we seldom or never find a body in dissection which has not adhesions in some of the larger cavities; and yet it may reasonably be supposed that many of these persons never had any acute symptoms or violent pain in those parts; indeed we find many strong adhesions upon the opening of dead bodies, in parts which the friends of these persons never heard mentioned, during life, as the subject of a single complaint.

That adhesions can be produced from very slight inflammation, is proved in ruptures in consequence of wearing a truss; for we find the slight pressure of a truss exciting such action as to thicken parts, by which means the two sides of the sac are united, though there be hardly any sensation in the part; we also see, in cases where this inflammation arises from violence, that it gives little or no pain. A small ball shall be shot through the cavity of the abdomen, and if none of the contained parts are materially hurt, the adhesive inflammation shall take place in all the internal parts contiguous to the wound made by the ball, and yet no great degree of pain shall be felt. This assertion is still proved by the little pain suffered after many bruises, where there is evident inflammation; and in simple fractures the pain from the inflammation is very trifling, whatever it may be from the laceration of the parts. But this will be according to the degree of inflammation, what state it is in, and what parts are inflamed, as will be fully explained hereafter.

We find it a common principle in the animal machine, that every part increases in some degree according to the action re-

quired. Thus we find muscles increase in size when much exercised; vessels become larger in proportion to the necessity of supply, as, for instance, in the gravid uterus: the external carotids in the stag, also, when his horns are growing, are much larger than at any other time; and I have observed, that in inflammation the vessels become larger, more blood passes, and there appear to be more actions taking place; but the nerves do not seem to undergo any change. The nerves of the gravid uterus are the same as when it is in the natural state; neither do the branches of the fifth and seventh pair of nerves in the stag become larger; and in inflammation of the nerves their blood-vessels are enlarged, and have coagulating lymph thrown into their interstices, but the nerve itself is not increased, so as to bring the part to the state of a natural part, fitted for acute sensation, which shows that the motions of the nerves have nothing to do with the æconomy of the part; they are only the messengers of intelligence and orders. It appears that only the action of the *materia vitæ* in the inflamed parts is increased, and this increase of action in the inflamed part is continued along the nerve which is not inflamed, to the mind, so that the impression on the sensorium is, probably, equal to the action of the inflamed *materia vitæ*.

The quantity of natural sensibility is, I believe, proportioned to the quantity of nerves, under any given circumstance; but I apprehend the diseased sensibility does not take place at all in this proportion, but in proportion to the diseased action of the *materia vitæ*. Thus a tendon has very little sensation when injured in a natural state; but let that tendon become inflamed, or otherwise diseased, and the sensation shall be very acute.

It may not be improper to observe, that many parts of the body in a natural state give peculiar sensations when impressed; and when those parts are injured they give likewise pain peculiar to themselves; it is this latter effect which I am to consider. I may also observe, that the same mode of impression shall give a peculiar sensation to one part, while it shall give pain to another. Thus, what will produce sickness in the stomach, will produce pain in the colon. When the sensation of pain is in a vital part

it is somewhat different from most of those pains that are common. Thus, when the pain arises from an injury done to the head, the sensation is a heavy stupifying pain, rendering the person affected unfit to pay attention to other sensations, and is often attended with sickness, from the stomach sympathizing with it. When the pain is in the heart or lungs it is more acute, and is very much confined to the part diseased. When in the stomach and intestines, especially the upper part of them, it is a heavy oppressive sickly pain, but more or less attended with sickness according to its pressure or proximity to the stomach; for when situated in the colon it is more acute, and less attended with sickness.

We cannot give a better illustration of this than by taking notice of the effects of a purge. If we take such a purge as will produce both sickness and griping, we can easily trace the progress of the medicine in the canal; when in the stomach it makes us sick, but we soon find the sickness becoming more faint, by which we can judge that it has proceeded to the duodenum; and then a kind of uneasiness, approaching to pain, succeeds; when this is the case we may be certain that the medicine is passing along the jejunum; it then begins to give a sickish griping pain, which I conceive belongs to the ileum; and when in the colon it is a sharp pain, soon after which a motion takes place.

The liver, testicles, and uterus are subject nearly to the same kind of pain as the stomach. A tendon, ligament, and bone give something of the same kind of pain, though not so oppressive, namely, a dull and heavy pain, often attended with some little sickness, the stomach generally sympathizing in such cases. But the skin, muscles, and the cellular membrane, in common, give an acute pain, which rather rouses than oppresses, if not too great. All of this will be further mentioned when we treat of each part.

One cause of this variety of sensations, according as the parts inflamed are vital or not vital, seems to consist in the different systems of *materia vitæ* with which those parts are supplied, having, probably, nerves peculiarly constructed for this purpose;

for all the parts which are supplied with branches from the pars vagum and intercostals affect the patient with lowness of spirits from the very first attack of the inflammation: the actions of those parts are involuntary, and therefore are more immediately connected with the living principle, and consequently that principle is affected whenever anything affects these nerves. The other system of the *materia vitæ*, when affected by this inflammation, rather rouses at first the constitution, which shows signs of strength, unless the parts have rather weak powers of recovery, such as tendon, bone, etc., or are far from the heart, in which cases the signs of weakness sooner or later appear: hence it would seem that this difference in the constitution, arising from the difference in parts and their situation, arises from the constitution having a disease which it cannot so easily manage, as it can in those parts which are not vital, and in parts that are near to the heart; which circumstances alone become a cause of irritation in the constitution.

### *3. The Heat of Parts in Inflammation*

When I was treating of the blood I observed that the heat of the animal was commonly considered as connected with that fluid; but as I had not made up my mind about the cause of the heat of animals, not being satisfied with the opinions hitherto given, I did not endeavour to offer any account of that property; but I shall now consider this power when the animal is under disease, where it would appear often to be diminished, and often increased, and of course the animal often becomes colder and hotter than its natural temperature.

There is an endeavour to bring the heat of a living body to the temperature of the surrounding medium, but in the more perfect animals this is prevented by the powers in the animal to support its own temperature, more especially in and near the vital parts; therefore, in making experiments, to ascertain any variation, it is not necessary to ascertain at the same time the temperature of the atmosphere.

Heat, I imagine, is a sign of strength and power of constitution, although it may often arise from an increased action either of weak constitutions or of weakened parts.

Heat is a positive action, while cold is the reverse, therefore producing weakness, and often arising from a diminished action of strong parts.

It has not yet been considered whether an animal has the power of producing heat equally in every part of the body, although, from what is generally advanced on this subject, we are led to suppose that every part has this power, or whether it is carried from some one source of heat by the blood to every part; this may probably not be easily determined; but I am apt to suspect there is a principal source of heat, although it may not be in the blood itself, the blood being only affected by having its source near the source of heat.

That this principle resides in the stomach is probable, or at least I am certain that affections of the stomach will produce either heat or cold. There are affections of the stomach which produce the sensation of heat in it, and the air that arises in eructations feels hot to the mouth of the person; but whether these sensations arise from actual heat, or from sensation only, I have not been able to determine. Stimulating substances applied to the stomach will produce a glow. Affections of the mind produce the same effect, which last circumstance might seem to contradict the idea of its arising from the stomach; but I suspect that the stomach sympathizes with those actions of the brain which form the mind, and then produces heat, which will be better illustrated in treating of cold. I suspect that the cold bath produces heat in the same way, from the sympathizing intercourse between the skin and the stomach.

That diseases augment or lessen this power in the animal is evident; for in many diseases the animal becomes much hotter, and in many others much colder than is usual to it. This fact was first discovered by simple sensation alone, both to the patients themselves and the practitioner, before the absolute measurement of the degrees of heat by instruments was known; but it was impossible that such knowledge of it could be accurate, for we find by experiment that the measurement of degrees of heat by sensation is very vague. This happens because the degree of heat in ourselves (which in such experiments is the instrument) is not of one standard, but must vary pretty much

before we are made sensible of the difference, and therefore there can be only a relative knowledge respecting our own heat at the time. But now our measurement is more determined, and can be brought even nearer to the truth than is absolutely necessary to be known in disease.

The increase and decrease of the heat of an animal body may be divided into constitutional and local. The constitutional arises from a constitutional affection, and may arise primarily in the constitution itself; or it probably may arise secondarily, as from a local disease with which the constitution sympathizes; but of this I am not yet certain, for from several experiments made to ascertain this point, it seemed to appear that local inflammation had little power of increasing the heat of the body beyond the natural standard, although the body was under the influence of the inflammation by sympathy, called the symptomatic fever; but if the heat of the body is below the natural heat, or that heat where actions, whether natural or diseased, are called forth, then the heat of the body is raised to its natural standard.

As it is the principle of increase of local heat in inflammation I am now to consider, it should be first ascertained how far such a principle exists in a part, and what that principle may be; the constitutional principle being in some measure not to the present purpose, although it may throw some light on the difference between the powers of the constitutional and those of the local principle. It is said that disease, as fever, has been known to raise the heat of the body to twelve degrees above the natural heat; and if so, then there is in such cases either an increased power or an increased exertion of that power; and to know whether this arises only from a constitutional affection at large, or whether it can take place in parts when the constitution is affected by those parts, is worthy of inquiry.

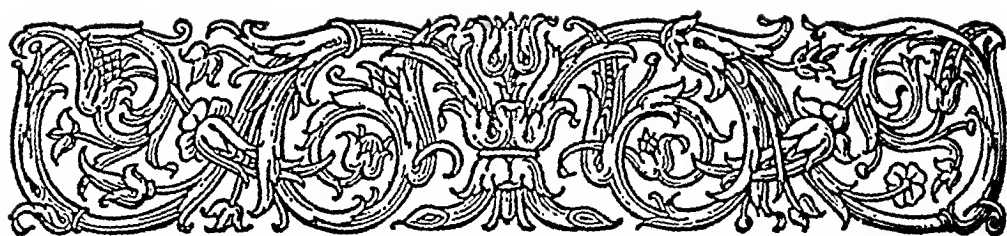
The principal instance of supposed increased local heat is in inflammation, and we find that external parts inflamed do actually become hotter; but let us see how far the increase goes. From all the observations and experiments I have made, I do not find that a local inflammation can increase the local heat

above the natural heat of the animal; and when in parts whose natural heat is inferior to that which is at the source of the circulation, it does not rise so high: those animals, too, which appear to have no power, either of increase or decrease in health, naturally appear to be equally deficient in disease, as will be seen in the experiments.

I suspect that the blood has an ultimate standard heat in itself when in health, and that nothing can increase that heat but some universal or constitutional affection; and probably the sympathetic fever is such as has now power in this way, and that the whole power of local inflammation is only to increase it a little in the part, but that it cannot bring it above the standard heat at the source, nor even up to it in parts that naturally or commonly do not come up to it, as just above mentioned.

As inflammation is the principal instance capable of producing local increased heat, I have taken the opportunity of examining inflammations, both when spontaneous and in consequence of operations. I have also made several experiments for that purpose, which are similar to operations, and cannot say that I ever saw, from all these experiments and observations, a case where the heat was really so much increased as it appeared to be to the sensations.





# A Treatise on the Venereal Disease<sup>\*</sup>

## PART VI

### CHAPTER II

#### OF THE SYMPTOMS OF THE LUES VENEREA

**W**HEN the venereal matter has affected the constitution in any of the ways before mentioned, it has the whole body to work upon, and shows itself in a variety of shapes, many of which putting on the appearance of a different disease, we are often obliged to have recourse to the preceding history of the case before we can form any judgement of it. Probably the varieties in the appearances may be referred to the three following circumstances: the different kinds of constitutions, the different kinds of solids affected, and the different dispositions which the solids are in at the time; for I can easily conceive that a peculiarity of constitution may make a very material difference in the appearance of the same specific complaint, and I am certain that the solids, according to their different natures, produce a very different appearance when attacked with this disease; and I can also easily conceive that a different disposition from the common in the solids at the time may make a considerable difference in the appearances.

The difference of constitution, and of the same parts at different times, may have considerable effects in the disease with respect to its appearing sooner or later. This I am certain of,

<sup>\*</sup>The Works of John Hunter, edited by J. F. Palmer. London, Longman, 1837, vol. II.

that the different parts of the body produce a very considerable difference in the times of appearance of this disease. That it appears much sooner in some parts than in others is best seen where different parts are affected in the same person; for I have already endeavoured to show that it is most probable that all the parts affected are contaminated nearly at the same time. This difference in the times is either owing to some parts being naturally put into action more easily by the poison than others, or they are naturally more active in themselves, and therefore probably will admit more quickly the action of every disease that is capable of affecting them.

When on the general history of the *lues venerea*, I divided the parts into two orders, according to the time of their appearance. I also observed that the first were commonly the external parts, as the skin, nose, tonsils; and that the second were more internal, as the bones, periosteum, fasciae, and tendons.

The time necessary for its appearance, or for producing its local effects in the several parts of the body most readily affected, after it has got into the constitution, is uncertain, but in general it is about six weeks; in many cases, however, it is much later, and in others much sooner. In some cases it appears to produce its local effects within a fortnight after the possibility of the absorption of the matter. In one case a gentleman had a chancre, and a swelling in the groin came on, and with the before-mentioned time he had venereal eruptions all over the body. He could not impute this to any former complaint, yet there is a possibility of its having arisen from the first mode of catching the disease, by simple contact, at the time he got the local or chancre, which might extend the time to a week or more, although this is not probable. In another case, three weeks after the healing of a chancre, eruptions broke out all over the body, and this happened only a fortnight after leaving off the course of mercury that cured the chancre. The effects on other parts of the body, that are less susceptible of this irritation, or are slower in their action, are of course much later in appearing; and in those cases where both orders of parts are contaminated it is in general not till after the first has made its appearance for a considerable time, and even

perhaps after it has been cured; for while the parts first in order of action were contaminated and under cure, the second in order are only in a state of contamination, and go on with the disease afterwards, although it may never again appear in the first.

From this circumstance of the parts second in order coming later into action, we can plainly see the reason why it shall appear in them, although the first in order may have been cured; for if the external parts, or first in order, have been cured, and the internal, or second, such as the tendons, bones, periosteum, &c., have not been cured, then it becomes confined solely to these parts. The order of parts may sometimes be inverted; for I have seen cases where the periosteum, or bone, was affected prior to any other part. Whether in the same case it might in the end have affected the skin or throat I will not pretend to say, as it was not allowed to go on; but it is possible that the second order of parts may be affected without the first having ever been contaminated.

Its effects on the deeper-seated parts are not like those produced in the external, and the difference is so remarkable as to give the appearance of another disease; and a person accustomed to see it in the first parts only would be entirely at a loss about the second.

The parts which come first into action go on with it, probably on the same principle, much quicker than the others; and this arises from the nature of the parts, as has already been observed.

Each succeeding part that becomes affected is slower and slower in its progress, and more fixed in its symptoms when produced; this arises also from the natural disposition of such parts, all their actions being slow, which indolent action may be assisted by the absence of the great disposing cause, that is cold. I should, however, suspect that warmth does not contribute much to their indolence of action; for if it did it would assist in the cure, which it appears not to do, these parts being as slow in their operations of restoration as they are in their actions of disease. We may also observe that similar parts come sooner into action, and appear to go on more rapidly with it, as they are nearer the source of the circulation. It appears earlier on the face, head,

shoulders, and breast than on the legs, and the eruptions come sooner to suppuration in the before-mentioned parts.

The circumstance of its being very late in appearing in some parts, when it had been only cured in its first appearances, as mentioned, has made many suppose that the poison lurked somewhere in the solids; and others that it kept circulating in the blood for years.

It is not, however, easy to determine this point; but there can be no good reason for the first hypothesis, as the lurking disposition never takes place prior to its first appearance; for instance, we never find that a man had a chancre a twelvemonth ago, and that it broke out after in venereal scurfs upon the skin, or ulcers in the throat. The slowness of its progress is only when the parts less susceptible of its irritation have been affected by it.

### *1. Of the Symptoms of the first stage of the Lues Venerea*

The first symptoms of the disease, after absorption, appear either on the skin, throat, or mouth. These differ from one another according to the nature of the parts affected. I shall therefore divide them into two kinds, although there appears to be no difference in the nature of the disease itself.

The appearance on the skin I shall call the first, although it is not always the first appearance; for that in the throat is often as early a symptom as any. The appearances upon the skin generally show themselves in every part of the body, no part being more susceptible than another, first in discolorations, making the skin appear mottled, many of them disappearing, while others continue and increase with the disease.

In others it will come on in distinct blotches, often not observed till scurfs are forming; at other times they appear in small distinct inflammations, containing matter and resembling pimples, but not so pyramidal, nor so red at the base.

Venereal blotches, at their first coming out, are often attended with inflammation, which gives them a degree of transparency, which I think is generally greater in the summer than in the winter, especially if the patient be kept warm. In a little time this inflammation disappears, and the cuticle peels off in the form

of a scurf. This sometimes misleads the patient and the surgeon, who look upon this dying away of the inflammation as a decay of the disease, till a succession of scurfs undeceives them.

These discolorations of the cuticle arise from the venereal irritation, and are seldom to be reckoned a true inflammation, for they seldom have any of its characteristics, such as tumefaction and pain; but this is true only on those parts most exposed, for in parts well covered, and in parts constantly in contact with other parts, there is more of the true inflammatory appearance, especially about the anus.

The appearance of the parts themselves next begins to alter, forming a copper-coloured dry inelastic cuticle, called a scurf; this is thrown off, and new ones are formed. These appearances spread to the breadth of a sixpence or shilling, but seldom broader, at least for a considerable time, every succeeding scurf becoming thicker and thicker, till at last it becomes a common scab, and the disposition for the formation of matter takes place in the cutis under the scab, so that at last it turns out a true ulcer, in which state it commonly spreads, although but slowly.

These appearances arise first from the gradual loss of the true sound cuticle, the diseased cutis having lost the disposition to form one; and, as a kind of substitute for this want of cuticle, an exudation takes place, forming a scale, and afterwards becoming thicker, and the matter acquiring more consistence, it at last forms a scab; but before it has arrived at this state the cutis has given way, and ulcerated, after which the discharge becomes more of a true pus. When it attacks the palms of the hands and the soles of the feet, where the cuticle is thick, a separation of the cuticle takes place, and it peels off, a new one is immediately formed, which also separates, so that a series of new cuticles takes place, from its not so readily forming scurfs as on the common skin. If the disease is confined to those parts it becomes more difficult to determine whether or not it be venereal, for most diseases of the cutis of these parts produce a separation of the cuticle attended with the same appearances in all, and having nothing characteristic of the venereal disease.

Such appearances are peculiar to that part of the common skin

of the body which is usually exposed; but when the skin is opposed by another skin which keeps it in some degree more moist, as between the nates, about the anus, or between the scrotum and the thigh, or in the angle between the two thighs, or upon the prolabium of the mouth, and in the armpits, the eruptions never acquire the above-described appearances, and instead of scurfs and scabs we have the skin elevated, or, as it were, tumefied by the extravasated lymph into a white, soft, moist, flat surface, which discharges a white matter. This may perhaps arise from there being more warmth, more perspiration, and less evaporation, as well as from the skin being thinner in such places. What strengthens this idea still more is, that in many venereal patients I have seen an approach towards such appearances on the common skin of the body; but this has been on such parts as were covered with the clothes, for on those parts of the skin that were not covered there was only the flat scurf; these, however, were redder than the above-described appearances, but hardly so high.

How far this is peculiar to the venereal disease I know not. It may take place in most scurfy eruptions of the skin. From a supposition of this not being venereal, I have destroyed them at the side of the anus with a caustic, and the patient has got well; however, from my idea of the disease, that every effect from the constitution is truly local, and therefore may be cured locally, a cure effected by this treatment does not determine the question.

This disease, on its first appearance, often attacks that part of the fingers upon which the nail is formed, making that surface red which is seen shining through the nail, and, if allowed to continue, a separation of the nail takes place, similar to the cuticle in the before-described symptoms; but here there cannot be that regular succession of nails as there is of cuticle.

It also attacks the superficies of the body which is covered with hair, producing a separation of the hair. A prevention of the growth of young hair is also the consequence while the disease lasts.

The second part in which it appears is most commonly the throat, sometimes the mouth and tongue. In the throat, ton-

sils, and inside of the mouth, the disease generally shows itself at once, in the form of an ulcer, without much previous tumefaction, so that the tonsils are not much enlarged; for when the venereal inflammation attacks these parts, it appears to be always upon the surface, and it very soon terminates in an ulcer.

These ulcers in the throat are to be carefully distinguished from all others of the same parts. It is to be remarked, that this disease, when it attacks the throat, always, I believe, produces an ulcer, although this is not commonly understood; for I have seen cases where no ulceration had taken place called, by mistake, venereal. It is therefore only this ulcer that is to be distinguished from other ulcers of these parts. This species of ulcer is generally tolerably well marked, yet it is perhaps in all cases not to be distinguished from others that attack this part, for some have the appearance of being venereal, and what are really venereal resemble those that are not. We have several diseases of this part which do not produce ulceration on the surface, one of which is common inflammation of the tonsils, which often suppurates in the centre, forming an abscess, which bursts by a small opening, but never looks like an ulcer begun upon the surface, as in the true venereal; this case is always attended with too much inflammation, pain, and tumefaction of the parts to be venereal; and if it suppurates and bursts it subsides directly, and it is generally attended with other inflammatory symptoms in the constitution.

There is another disease of these parts, which is an indolent tumefaction of the tonsils, and is peculiar to many people whose constitutions have something of the scrofula in them, producing a thickness in the speech. Sometimes the coagulable lymph is thrown out on the surface, and called by some ulcers, by others sloughs, and such are often called putrid sore throats. Those commonly swell to too large a size for the venereal; and this appearance is easily distinguished from an ulcer or loss of substance: however, where it is not plain at first sight it will be right to endeavour to remove some of it; and if the surface of the tonsil is not ulcerated, then we may be sure it is not venereal. I have seen a chink filled with this, appearing very much like an ulcer,

but upon removing the coagulable lymph the tonsil has appeared perfectly sound. I have seen cases of a swelled tonsil where a slough formed in its centre, and that slough has opened a passage out for itself, and when it has been, as it were sticking in this passage, it has appeared like a foul ulcer.

The most puzzling stage of the complaint is when the slough is come out, for then it has most of the characters of the venereal ulcer; but when I have seen the disease in its first stages I have always treated it as of the erysipelatous kind, or as something of the nature of a carbuncle.

When I have seen them in their second state only I have been apt to suppose them venereal: however, no man will be so rash as to pronounce what a disease is from the eye only, but will make inquiries into all the circumstances before he forms a judgment. If there have been no preceding local symptoms within the proper date he will suspend his judgment, and wait a little to see how far Nature is able to relieve herself. If there has been any preceding fever, it will be still less probable that it is venereal. However, I will not say of what nature such cases are, but only that they are not venereal as they are often believed to be. I have seen a sore throat of this kind mistaken for venereal, and mercury given till it affected the mouth, which when it did, it brought on a mortification on all the parts concerned in the first disease. It would therefore appear that this species of the sore throat is aggravated by mercury.

There is another complaint of those parts which is often taken for venereal, which is an ulcerous excoriation, where the ulceration or excoriations run along the surface of the parts, becoming very broad, and sometimes foul, having a regular termination, but never going deep into the substance of the parts, as the venereal ulcer does. There is no part of the inside of the mouth exempted from this ulcerous excoriation, but I think it is most frequent about the root of the uvula, and spreads forwards along the palatum molle. That such are not venereal is evident, from their not giving way in general to mercury; and I have seen them continue for weeks without altering, and a true venereal ulcer appear upon the centre of the excoriated part.



The difference between the two is so strong that there can be no mistake; patients have gone through a course of mercury which has perfectly cured the venereal ulcers, but has had no effect upon the others, which have afterwards been cured by bark.

The true venereal ulcer in the throat is perhaps the least liable to be mistaken of any of the forms of the disease. It is a fair loss of substance, part being dug out, as it were, from the body of the tonsil, with a determined edge, and is commonly very foul, having thick white matter adhering to it like a slough, which cannot be washed away.

Ulcers in such situations are always kept moist, the matter not being allowed to dry and form scabs, as in those upon the skin; the matter is carried off the ulcers by deglutition, or the motion of the parts, so that no succession of scurfs or scabs can take place, as on the skin.

Their progress is also much more rapid than on the common skin, ulceration taking place very fast.

Like most other spreading ulcers, they are generally very foul, and for the most part have thickened or bordered edges, which is very common to venereal or cancerous sores, and indeed to most sores which have no disposition to heal, whatever the specific disease may be.

When it attacks the tongue it sometimes produces a thickening and hardness in the part; but this is not always the case, for it very often ulcerates, as in the other parts of the mouth.

They are generally more painful than those of the skin, although not so much so as common sore throats arising from inflamed tonsils.

They oblige the person to speak thick, or as if his tongue was too large for his mouth, with a small degree of snuffling.

These are the most common symptoms of this state of the disease, but it is perhaps impossible to know all the symptoms this poison produces when in the constitution. I knew a gentleman who had a teasing cough which he imputed to it; for it came on with the symptomatic fever, and continued with it, and by using mercury both disappeared.

There are inflammations of the eyes which are supposed to be

venereal; for after the usual remedies against inflammation have been tried in vain, mercury has been given, on the supposition of the case being venereal, and sometimes with success, which had tended to establish this opinion. But if such cases are venereal, the disease is very different from what it is when attacking other parts from the constitution, for the inflammation is more painful than in venereal inflammation proceeding from the constitution; and I have never seen such cases attended with ulceration, as in the mouth, throat, and tongue, which makes me doubt much of their being venereal.

*2. Experiments made to ascertain the Progress and Effects of the Venereal Poison*

To ascertain several facts relative to the venereal disease, the following experiments were made. They were begun in May 1767.

Two punctures were made on the penis with a lancet dipped in venereal matter from a gonorrhoea; one puncture was on the glans, the other on the prepuce.

This was on a Friday; on the Sunday following there was a teasing itching in those parts, which lasted till the Tuesday following. In the mean time, these parts being often examined, there seemed to be a greater redness and moisture than usual, which was imputed to the parts being rubbed. Upon the Tuesday morning the parts of the prepuce where the puncture had been made were redder, thickened, and had formed a speck; by the Tuesday following the speck had increased, and discharged some matter, and there seemed to be a little pouting of the lips of the urethra, also a sensation in it in making water, so that a discharge was expected from it. The speck was now touched with lunar caustic, and afterwards dressed with calomel ointment. On Saturday morning the slough came off, and it was again touched, and another slough came off on the Monday following. The preceding night the glans had itched a good deal, and on Tuesday a white speck was observed where the puncture had been made; this speck, when examined, was found to be a pimple full of yellowish matter. This was now touched with the caustic,

and dressed as the former. On the Wednesday the sore on the prepuce was yellow, and therefore was again touched with caustic. On the Friday both sloughs came off, and the sore on the prepuce looked red, and its basis was not so hard; but on the Saturday it did not look quite so well, and was touched again, and when that went off it was allowed to heal, as also the other, which left a dent in the glans. This dent on the glans was filled up in some months, but for a considerable time it had a bluish cast.

Four months afterwards the chancre on the prepuce broke out again, and very stimulating applications were tried; but these seemed not to agree with it, and nothing being applied, it healed up. This it did several times afterwards, but always healed up without any application to it. That on the glans never did break out, and herein also it differed from the other.

While the sores remained on the prepuce and glans a swelling took place in one of the glands of the right groin. I had for some time conceived an idea that the most effectual way to put back a bubo was to rub in mercury on that leg and thigh; that thus a current of mercury would pass through the inflamed gland. There was a good opportunity of making the experiment. I had often succeeded in this way, but now wanted to put it more critically to the test. The sores upon the penis were healed before the reduction of the bubo was attempted. A few days after beginning the mercury in this method the gland subsided considerably. It was then left off, for the intention was not to cure it completely at present. The gland some time after began to swell again, and as much mercury was rubbed in as appeared to be sufficient for the entire reduction of the gland; but it was meant to do no more than to cure the gland locally, without giving enough to prevent the constitution from being contaminated.

About two months after the last attack of the bubo, a little sharp pricking pain was felt in one of the tonsils in swallowing anything, and on inspection a small ulcer was found, which was allowed to go on till the nature of it was ascertained, and then recourse was had to mercury. The mercury was thrown in by the same leg and thigh as before, to secure the gland more effectually, although that was not now probably necessary.

As soon as the ulcer was skinned over the mercury was left off, it not being intended to destroy the poison, but to observe what parts it would next affect. About three months after, copper-coloured blotches broke out on the skin, and the former ulcer returned in the tonsil. Mercury was now applied the second time for those effects of the poison upon the constitution, but still only with a view to palliate.

It was left off a second time, and the attention was given to mark where it would break out next; but it returned again in the same parts. It not appearing that any further knowledge was to be procured by only palliating the disease a fourth time in the tonsil, and a third time in the skin, mercury was now taken in a sufficient quantity, and for a proper time, to complete the cure.

The time the experiments took up, from the first insertion to the complete cure, was about three years.

The above case is only uncommon in the mode of contracting the disease, and the particular views with which some parts of the treatment were directed; but as it was meant to prove many things which though not uncommon, are yet not attended to, attention was paid to all the circumstances. It proves many things, and opens a field for further conjectures.

It proves, first, that matter from a gonorrhoea will produce chancres.

It makes it probable that the glans does not admit the venereal irritation so quickly as the prepuce. The chancre on the prepuce inflamed and suppurated in somewhat more than three days, and that on the glans in about ten. This is probably the reason why the glans did not throw off its sloughs so soon.

It renders it highly probable that to apply mercury to the legs and thighs is the best method of resolving a bubo; and therefore also the best method of applying mercury to assist in the cure, even when the bubo suppurates.

It also shows that buboes may be resolved in this way, and yet the constitution not be safe; and therefore that more mercury should be thrown in, especially in cases of easy resolution, than what simply resolves the bubo.

It shows that parts may be contaminated, and may have the

poison kept dormant in them while under a course of mercury for other symptoms, but break out afterwards.

It also shows that the poison having originally only contaminated certain parts, when not completely cured, can break out again only in those parts.

### *3. Of the Symptoms of the Second Stage of the Lues Venerea*

This stage of the disease is not so well marked as the former; and, as it is of more importance, it requires all our discernment to determine what the disease is.

The parts less susceptible of this irritation are such as are more out of the way of the great exciting cause, which is the external air, as has been before related. And they begin to take on the venereal action whether it may or it may not have produced its local effects upon the external or exposed surfaces; and they even go on with the action, in many cases, after the surfaces first affected have taken on the action and have been cured, as has been already observed. These deeper-seated parts are the periosteum, tendons, fasciae, and ligaments; however, what the parts affected may be when the disease is in this stage is not always certain: I have known it produce total deafness, and some of those cases to end in suppuration, attended with great pain in the ear and side of the head. Such cases are generally supposed to arise from some other cause; and nothing but some particular circumstance in the history of the case, or some symptom attending it, can lead the surgeon to the nature of the complaint.

When these deeper-seated parts become irritated by this poison the progress is more gradual than in the first: they have very much the character of scrofulous swellings or chronic rheumatism, only in this disease the joints are not so subject to it as they are in the rheumatism. We shall find a swelling come upon a bone when there has been no possible means of catching the infection for many months, and it will be of some size before it is taken notice of, from having given but little pain. On the other hand, there shall be great pain, and probably no swelling to be observed till some time after. The same observations are applicable to the swelling of tendons, and fasciae.

As these swellings increase by slow degrees, they show but little signs of inflammation. When they attack the periosteum the swelling has all the appearance of a swelling of the bone, by being firm and closely connected with it.

The inflammation produced in these later stages of the disease can hardly get beyond the adhesive, in which state it continues growing worse and worse, and when matter is formed it is not true pus but a slimy matter. This may arise in some degree from the nature of the parts not being in themselves easily made to suppurate; and when they do suppurate the same languidness still continues, insomuch that this matter is not capable of giving the extraneous stimulus, so as to excite true suppuration or ulceration, even after the constitution is cleared of the original cause, and then the disease is probably scrofulous. Some nodes, either in the tendons or bones, last for years before they form any matter at all; and in this case it is doubtful whether they are venereal or not, although commonly supposed to be so.

I have already observed that the pain in the first stages of this disease is much less than might be expected, considering the effects produced by the poison. The disease being very slow and gradual in its progress, its giving little pain may be accounted for. An ulcer in the throat causes no great pain; and the same may be said of blotches on the skin, even when they become large sores.

When the periosteum and bones become affected the pain is sometimes very considerable, and at other times there is hardly any. It is not perhaps easy to account for this. We know also that the tendinous parts, when inflamed, give in some cases very considerable pain, and that of the heavy kind, while in others they will swell considerably without giving any pain.

These pains are commonly periodical, or have their exacerbations, being commonly worst in the night. This is common to other aches or pains, especially of the rheumatic kind, which the venereal pains resemble very much.

When the pain is the first symptom, it affords no distinguishing mark of the disease; it is therefore often taken for the rheumatism.

*4. Of the Effects of the Poison on the Constitution*

The poisonous matter, simply as extraneous matter, produces no change whatever upon the constitution, and whatever effects it has depend wholly upon its specific quality as a poison. The general effects of this poison on the constitution are similar to other irritations, either local or constitutional. It produces fever, which is of the slow kind; and when it continues a considerable time it produces what is called a hectic disposition, which is no more than an habitual slow fever arising from a cause which the constitution cannot overcome. While this exists it is impossible that anything salutary can go on in such a constitution. The patient loses his appetite, or even if his appetite is good, loses his flesh, becomes restless, loses his sleep, and looks sallow.

In the first stage of this disease, before it begins to show itself externally, the patient has generally rigors, hot fits, headaches, and all the symptoms of an approaching fever.

These symptoms continuing for some days, and often for weeks, show that there is some irritating cause which works slowly upon the constitution. It is then supposed to be whatever the invention or ingenuity of the practitioner shall call it; but the venereal eruptions or nodes upon either the periosteum, bones, tendons, or other parts appearing, show the cause, and in some degree carry off the symptoms of fever and relieve the constitution for a little time, but they soon recur.

These constitutional complaints, however, are not always to be found, the poison stimulating so slowly as hardly to affect the constitution, unless it be allowed to remain in it a long time.

There are a number of local appearances, mentioned by authors, which I never saw, such as the fissures about the anus, &c. There are also a number of diseases described by authors as venereal, especially by Astruc and his followers, which are almost endless. The cancer, scrofula, rheumatism, and gout have been considered as arising from it, which may be in some measure true; but they are with them the disease itself, and all their consequences, as consumption, wasting from want of nourishment,

jaundice, and a thousand other diseases, which happened many years before the existence of the lues venerea, are all attributed to it.

There is even at this day hardly any disease the practitioner is puzzled about, but the venereal comes immediately into his mind; and if this became the cause of careful investigation it would be productive of good, but with many the idea alone satisfies the mind.





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*Compiled by*

EMERSON CROSBY KELLY, M.D., F.A.C.S.

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GEORGE RYERSON FOWLER, M.D.

[1848-1906]

# MEDICAL CLASSICS

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## George Ryerson Fowler

### BIOGRAPHY

- 1848 Born December 25, in New York City. His father was a master mechanic in charge of repair shops on the Long Island Railroad and moved to Jamaica where the son attended school.
- 1871 Age 23. Received M.D. degree from Bellevue Hospital Medical College. Took no internship but went directly into general practice for about fifteen years.
- 1872 Age 24. Became member of Medical Society, County of Kings, New York. Surgeon at Central Dispensary until 1874.
- 1873 Age 25. Married Miss Louise Rachel Wells of Norristown, Pa. Blessed with four children, one of whom is Dr. Russell Story Fowler of Brooklyn, N. Y.
- 1877 Age 29. Assistant Surgeon, rank of Captain, 14th Reg., N. G. N. Y., until June 2, 1886.
- 1878 Age 30. Surgeon to Bushwick and East Brooklyn Dispensaries until 1887. Member of Brooklyn Anatomical and Surgical Society.
1880. Age 32. Member of New York Physicians' Mutual Aid Association.
- 1882 Age 34. Consulting surgeon to King's County Hospital until 1883. Member of Brooklyn Pathological Society.
1883. Age 35. Surgeon to St. Mary's Hospital, Jamaica, L. I., until 1895.
- 1886 Age 38. Surgeon, rank of Major, 14th Reg., N. G. N. Y., from June 2 to October 2, 1886. President of Medical Society, County of Kings. Member of New York Academy of Medicine.

- 1887 Age 39. One of two attending surgeons to Seney Methodist Episcopal Hospital, Brooklyn. Member of Brooklyn Surgical Society. Consulting surgeon to Bushwick Hospital.
- 1888 Age 40. Member of Society of Medical Jurisprudence.
- 1889 Age 41. Permanent member of New York Medical Society. Member of Associated Physicians of Long Island.
- 1890 Age 42. First President of Brooklyn Red Cross Society. Member of American Medical Association. President of Brooklyn Anatomical and Surgical Society. Examiner in Surgery to Board of Regents of the University of the State of New York until 1906. President of Brooklyn Surgical Society.
- 1891 Age 43. Fellow of American Surgical Society.
- 1892 Age 44. Member of Brooklyn Medical Book Club. Member of National Association of Railway Surgeons. Member of New York Surgical Society.
- 1894 Age 46. Consulting surgeon to St. John's Hospital and to Norwegian Hospital.
- 1895 Age 47. Consulting surgeon to Relief Hospital of Eastern District.
- 1896 Age 48. President of Brooklyn Alumni Association of Bellevue Hospital Medical College. Surgeon-in-Chief at Brooklyn Hospital until 1906. Professor of Surgery in New York Polyclinic Medical School until 1902.
- 1897 Age 49. Delegate to International Medical Congress in Moscow.
- 1898 Age 50. Treasurer of American Surgical Society. Chief Surgeon of Division, United States Volunteers, being commissioned by President McKinley with rank of Major, served in Cuba in Spanish-American War as chief of operating staff of Seventh Army Corps.
- 1899 Age 51. Consulting surgeon to Nassau Hospital, Hempstead, L. I. Visiting surgeon to German Hospital.
- 1900 Age 52. Delegate to International Medical Congress in Paris. Described Fowler's Position.

- 1901 Age 53. Described Fowler's Operation, pleurectomy.  
 1902 Age 54. Surgeon, N. G. N. Y., rank of Colonel, on Staff of Major-General Francis E. Roe. Member of Medical Association of the Greater City of New York. Professor Emeritus of New York Polyclinic Medical School.  
 1903 Age 55. Consulting surgeon to St. Mary the Immaculate Hospital, Jamaica, L. I. Brevetted Brigadier-General February 16, by Governor Odell.  
 1906 Age 58. Died February 6 of acute appendicitis in Albany, N. Y., after an operation Jan. 29 at Albany Hospital.

Chairman of Board of Trustees of Medical Society of the County of Kings.

Honorary Member of Association of Military Surgeons of the United States.

Verein Deutscher Aerzte von Brooklyn

Deutsche Hospital Gesellschaft von Brooklyn.

Membre de la Société Internationale de Chirurgie.

George R. Fowler was of medium height, compactly built, with a frank attractive countenance, and a piercing eye. He was companionable and engaging in his relations with his fellows, always kindly and sympathetic in his attitude to those who sought his help. He had a breezy positive way about him that could not fail to awaken the confidence of those with whom he came in contact. He always carried his profession with him and loved to talk about any phase of it. He left an enduring impression upon the community in which he lived as well as upon the surgery which he loved. In the work of his pupils and of his sons who now occupy positions of responsibility in the surgical world he still lives.—Lewis S. Pilcher, Surg. Gynec. Obstet., 37: 564, 1923.

## EPONYMS

1. BOUIGIES—Otis.
2. DREDGER—iodoform, single and triplex.



3. INHALER—modification of Allis inhaler.
4. OPERATION—Pleurectomy; decortication of the lung in empyema in order to allow the lung tissue to expand and fill the pleural space.
5. POSITION—The semi-sitting posture for treatment of acute peritonitis; the elevated head and trunk posture, to facilitate drainage into the pelvis.
6. SOUNDS.
7. TREATMENT OR FOWLER-MURPHY (J. B.) TREATMENT—Treatment of peritonitis by placing patient in Fowler position to favor drainage from pelvis and abdomen, and then making continuous irrigation of the lower bowel with physiologic salt solution administered slowly. See Position.

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## INTRODUCTION

Appendicitis has undoubtedly afflicted mankind from earliest times. In the writings of the ancients we frequently find descriptions which coincide with the history of appendicitis as we know it today, but the ancient writers, not knowing of the underlying pathology, were so vague in describing symptoms and signs that it is impossible for us to be sure that they recognized this disease. Many of the accounts of iliac passion may concern appendicitis. Certainly many people will remember when the term "inflammation of the bowels" was used to cover a lack of definite knowledge of the disease within the abdomen.

Jean Fernel is given credit as the first to describe a case of acute appendicitis with perforation. In his book, *Universa medicina*, published in Frankfort in 1581, he describes the symptoms and signs of a patient and the postmortem findings. Even here, however, there is a difference of opinion as to whether Fernel was recording perforation of the appendix or of the cecum. Lorenz Heister in 1711 performed a post mortem examination on a patient who had died of appendicitis. He recognized the importance of the lesion but was unable to give any history of his subject. In 1766 Joubert De La Motte reported an acute inflammation of the appendix, an observation he "made at the opening of a body of a person dead of tympanites." James Parkinson who is today remembered for his *Essay on the shaking palsy* (See MEDICAL CLASSICS, Volume II, No. 10), described the history and post mortem findings of a boy who died of appendicitis. This account was published in the Medical and Surgical Transactions of London in 1812. Thomas Hodgkin, a portion of whose writings has been published in MEDICAL CLASSICS, Volume I, No. 7, also described appendicitis in 1836.

However, the first man truly to associate the clinical history and the underlying pathology of appendicitis was Reginald Fitz of Boston. Since the publication of his classic paper in the Boston Medical and Surgical Journal of 1886 (See MEDICAL CLASSICS, Volume II, No. 5), the study of appendicitis has been elevated to a scientific level. The impetus which the work of Fitz gave to the study of appendicitis was furthered by many surgeons. In America the work of McBurney, Kelly, Morris, Murphy, McArthur, Halsted, Fowler and Ochsner made valuable additions to this study. The contribution of Charles McBurney of New York in describing the point of maximum tenderness on the abdominal wall in appendicitis and a suitable incision for the removal of that organ will be found in MEDICAL CLASSICS, Volume II, No. 5.

Six years after McBurney's contribution George Ryerson Fowler of Brooklyn published in 1900 a work which is herein reproduced, *Diffuse septic peritonitis with special reference to a new method of*



*treatment, namely, the elevated head and trunk posture, to facilitate drainage to the pelvis, with a report of nine consecutive cases of recovery.*

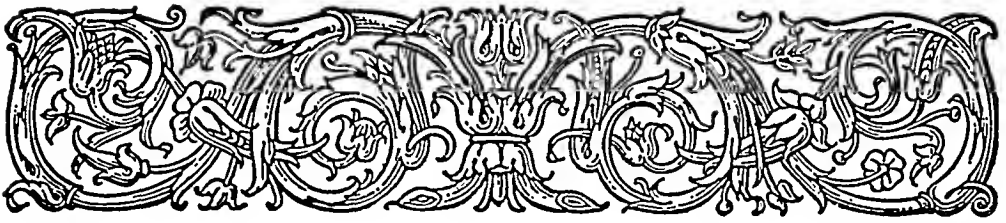
This position was possibly suggested to Fowler by the Gorham adjustable bed designed in 1892 by Dr. George E. Gorham of Albany, father of Dr. L. Whittington Gorham, Professor of Medicine at the Albany Medical College and Physician-in-chief at the Albany Hospital. By using this bed the elevated head and trunk posture was easily retained.

Dr. Fowler gives credit to his son and assistant, Dr. Russell S. Fowler of Brooklyn, for advocating the elevated head and trunk posture and for collaborating in the study of its application to peritonitis.

Since 1900 this position which has been called by the name of Fowler has aided greatly in the successful treatment, not only of peritonitis following appendicitis but from whatever cause. It has aided in saving innumerable lives. This notable paper is a fitting contribution to MEDICAL CLASSICS.

One year following Fowler's contribution Albert John Ochsner published an address on *The cause of diffuse peritonitis complicating appendicitis and its prevention*. In this paper, republished herein in its entirety, he advocated what we may call the rest cure of peritonitis. He recognized that peristalsis of the intestine aids in spreading an infection of the peritoneum and that a physiologic rest of the inflamed membrane would allow adhesions to form and to wall off the infection. He advised the prohibition of food or cathartics and recommended the early use of gastric lavage to empty the stomach. By using this conservative procedure Ochsner saw many serious cases of peritonitis change into walled-off abscesses. Ochsner's paper then is an adaptation of the principle of rest which was advocated by Hilton in 1876.

Today the principles of both Fowler and Ochsner are used in every surgical clinic. It is true that each surgeon may vary the principles to suit his own ideas but to the guidance of these two master surgeons the entire medical profession is indebted for their blazing of the trail.



Diffuse Septic Peritonitis, with  
Special Reference to a New  
Method of Treatment, Namely,  
the Elevated Head and Trunk  
Posture, to Facilitate Drain-  
age into the Pelvis, with a  
Report of Nine Consecu-  
tive Cases of Recovery

BY

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*Read before the Brooklyn Surgical Society, March 1, 1900. Enlarged and revised since its  
first presentation*

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**T**HE peritoneum is virtually an enormous lymph sac, and therefore peritonitis is lymphangitis. The absorbents of the structure of the peritoneum are represented by the lymphatics, and the protection which these afford against infecting agents by exudative material thrown out (thrombo-lymphangitis) to act as a defensive barrier by blocking the lymph channels serves to preserve the life of the

subject, on the one hand; while a failure in this respect, either because of the enormous and overwhelmingly rapid increase of septic material and the large size and number of channels necessary to destroy or obstruct, on the other hand, permits the destruction of the organism. Hence rapidly proliferating bacterial invasion means more or less absorption, perhaps sufficient to destroy life, before proper protection has been afforded in the manner mentioned. Or, on the contrary, a slow proliferation permits of the formation of exudative barriers to the extent of arresting further absorption and saving life.

The bacterial fluid present in a case of peritonitis is a transuded fluid, which, in the process of transudation, forces the endothelial cells from the peritoneal lymphatic surfaces; the desquamated cells, together with leucocytes and other cell-forms, floating about in the fluid. In cases of recent origin flakes of lymph are also present in the fluid. Patches of a coagulated albuminous substance, the result of the exudation of an albuminous fluid from the lymph channels and of fibrin from the blood (fibrinous exudate), appear as a soft, reddish-gray substance more or less adherent to the peritoneal surfaces, and here and there bridging over the spaces between adjacent coils of intestine, through the medium of which they adhere together.

The infecting agents also present in the fluid are invaders to be gotten rid of or prevented from proliferating and exerting their baneful effects, through the medium of the larger leucocytes, or macrophages of Metchnikoff, which migrate to the peritoneal cavity for this purpose. In order to effect their purpose these must come in contact with the microbes, either investing the latter to imprison and sterilize them, or checking their movements by simply adhering to them. The presence of a large quantity of fluid in the cavity of the peritoneum must necessarily interfere greatly with this contact between the leucocytes or macrophages and the invading and proliferating bacteria, since the contact, under these circumstances, must be more or less infrequent and of an accidental character. It is now believed that one of the functions of the omentum is to bring about this contact by its movements in the peritoneal cavity causing the

bacteria to adhere to its surfaces, where they are readily attacked by the leucocytes. This view is supported by the clinical fact that whenever a focus of infection exists in the peritoneal cavity, there are more than likely to be found omental folds, reaching out, so to speak, for the bacterial intruders and becoming adherent to the peritoneal surfaces adjacent to the focus during the process.

Not all of the regions of the peritoneum possess the physiological power of absorption to the same extent, for the reason that certain anatomical differences preclude this. For instance, the portion possessing this in the highest degree is the region of the diaphragm, where large lymph trunks are present, the open mouths or stomata of which stand ready to take up and transport to the system at large whatever fluid with its contained pus, blood, bacteria, or toxic products of the latter, may present itself. The size of both lymph trunks and stomata in this region is such as to prevent their early or rapid obliteration through thrombo-lymphangitis, and hence the organism may be destroyed through the widespread distribution of septic material before this can occur. This is particularly true of that portion of the region of the diaphragm known as its central or tendinous portion.

The region in which the anatomical conditions favoring rapid absorption exist in the next highest degree is the intestinal. Here there likewise exist large lymph trunks and stomata, but not to the same extent as are found in the region of the diaphragm. These are, however, sufficiently numerous to render this region a dangerous area of absorption.

Turning now to the remaining region, namely, the pelvic, we find that the non-absorptive character of the peritoneum is apparent. Microscopical study of this portion of the peritoneum reveals the fact that, while it is rich in capillary lymphatics, large lymph trunks and stomata are comparatively absent. The smaller lymph vessels of this region become much more rapidly obstructed, and hence absorption from this region proceeds very slowly, and finally ceases altogether, the arrest being coincident with plugging of the capillary lymph vessels with lymph thrombi, the result of infection and consequent inflammation of the lymph

vessels themselves, aided by pressure from without, the latter resulting from peri- and paralympangitis. This cessation persists until the toxic properties of the contents of the pelvic cavity are either destroyed or neutralized, when absorption is resumed through some, but not all, of the vessels. Many of the latter remain permanently closed. The latter circumstances correspond to the clinical fact that in some patients many attacks of pelvic peritonitis result in the formation of chronic exudates, due to the inability on the part of the absorbents to remove the latter, at least for a long time.<sup>1</sup>

It is likewise probably true that a certain immunity is conferred upon the peritoneal structure of the pelvis through previous attacks. And inasmuch as invasion of the pelvic cavity may readily occur through fecal stasis in the adjacent rectum in both sexes, and through the open mouths of the Fallopian tubes in the female, it is fair to assume that a certain degree of immunity or non-susceptibility is possessed by the peritoneum in that region through the permanent closure of its lymphatics, which is not shared by that in the other regions.

Reasoning from the facts above set forth, the practical surgeon should be able, in support thereof, to bring to bear evidence that the pelvic peritoneum is less liable to become the seat of danger in cases of septic invasion of the latter. He should be able to show, first, that the pelvic peritoneum possesses a certain degree of non-susceptibility to bacterial invasion; second, that when this does occur the spread therefrom is sufficiently slow to permit of the formation of exudative barriers protecting the more susceptible enteronic and diaphragmatic areas; and third, that the occurrence and retention of large quantities of septic fluid in the pelvic cavity do not give rise to the symptoms referable to the system in general characteristic of the presence of such fluid in the cavity of the peritoneum. In support of this contention that these requirements are successfully met by clinical experience, the following is offered:

<sup>1</sup> See the able presentation of the facts bearing upon this subject by Dr. Byron Robinson, of Chicago, in an article entitled "The Pathology of the Lymphatics of the Peritoneum," in the *Annals of Surgery*, vol. XXXI, No. 2, p. 214.

It has long been noted by surgeons that septic inflammatory processes when confined to the most dependent portion of the peritoneal cavity remain quiescent and without urgent symptoms for quite a period of time, as compared with a like condition of affairs existing in that portion of the peritoneal cavity situated above the pelvis. The facts that puerperal infection occurs with comparative infrequency in the large number of cases of labor among the poor, attended by those but little if at all acquainted with aseptic methods; that this, when it does occur, extends to the general peritoneum in a relatively small proportion of cases in which the peritoneum of the pelvic region is involved; and, still further, that infective processes in this region do not, as a rule, give rise to the same grave symptoms as an equal area of peritoneum infected in the abdominal cavity—still further suggest the theory that the peritoneum in this region is possessed of qualities which enable it, first, to resist infection; second, to limit the infection within its own area when it does occur, and third, either so to modify the virulence of the infection or to resist the absorption of its toxic products as to prevent, in the great majority of cases, the grave constitutional symptoms characteristic of an equally extensive infection of the peritoneum above the pelvis. These qualities are still further emphasized by the fact that operative procedures involving the pelvic peritoneum performed by the vaginal route conducted as they must necessarily be in close proximity to a region difficult, if not impossible, of even relative disinfection and isolation, namely, the anal region, seem less liable to be followed by septic peritoneal inflammation than the same procedures conducted by the abdominal route. In the case of suppurative salpingitis, at least, it cannot be urged that this comparative immunity is due to the non-entrance of septic or pyogenic micro-organisms, since, in order to remove the parts involved, it becomes necessary to break down limiting adhesions; in some instances rupture of the walls of abscess cavities occurs as well, thus leading to contamination of the surroundings in spite of a preliminary aspiration of the contents. Yet the patient escapes the peritoneal inflammation which so frequently follows when invasion of the general cavity of the peritoneum by the pus occurs, as it will in spite of every precaution.

The claim that this comparative immunity is due to the fact that the infecting organism largely concerned in pelvic inflammation, namely, the gonococcus of Neisser, is not necessarily pyogenic in character, in the cases of pyosalpinx at least, falls to the ground in the face of the experience of surgeons in those instances in which this micro-organism is sufficiently virulent to produce the metastatic joint conditions known as gonorrhoeal rheumatism, which, after all, is but a variety of pyemia. So pronounced does this joint condition sometimes become that destructive processes following this infection occur, bacterial examination of the fluids of the joint removed by operation showing the undoubted presence of the gonococcus. I am aware that a contrary view is held by many competent and careful observers, Kelly particularly, who states that, in many hundreds of bacteriological examinations made, he has never yet been able to demonstrate this micro-organism as the etiological factor in the production of septic peritonitis. It is nevertheless true that other and well-known organisms capable of producing both local and general septic conditions are destroyed after a time by the growth of other and more vigorously active bacteria, failure to identify these resulting. It cannot therefore be absolutely claimed that the gonococcus is non-infecting to the peritoneum, since the micro-organism frequently attacks the serous lining of joints. On the contrary, experience seems to prove that it has a special affinity for serous membranes, since it rarely invades by metastasis other structures. In common with many others, I at one time believed that the pus from a pyosalpinx ruptured during the removal of a gonorrhoeal pus tube by the abdominal route would do but little if any harm, even if it did come in contact with unprotected intestine and thereby found its way into the general peritoneal cavity. But I have long since learned by sad experience the fallacy of this view, and while admitting that the gonococcus infection may do comparatively but little if any harm to the peritoneum of the pelvic cavity, yet I am more than convinced that its contact with that portion of the folds or reflections of the peritoneum constituting the mesentery of the small intestine is fraught with danger. At the present time my plans to prevent this accident are as well laid, and my anxiety lest it should occur

as keen, as if I knew for a certainty that I was dealing with a violently infectious micro-organism.

Aside from the virulence of the bacterial contents of abscesses resulting from non-puerperal pelvic inflammation, the latter, as it arises from full-term deliveries and from abortions as well, may be considered. Here the claim cannot be made that the infecting agent is of a less virulent character than those which gain entrance to the cavity of the general peritoneum; certainly it will not suffice to say that all cases of pelvic peritonitis in the female are due to gonococcus infection. Yet how many of this class come under the surgeon's knowledge in which the septic processes are confined to the pelvis, and in which the local infection is out of all proportion to the general symptoms, in precisely the same manner as the cases indubitably due to gonorrheal infection. And the same may be said of those cases in which the uterus is accidentally punctured during a curettage for septic conditions of the endometrium. That such accidents occur more frequently than is generally supposed, I am convinced, yet I am informed by a well-known obstetrician and gynecologist who comes in frequent and intimate contact with those who follow especially this kind of surgical work, that these do not regard the occurrence of this class of accidents as of grave importance; not sufficiently so, at least, to warrant opening the peritoneal cavity for purposes of repair, much less for cleansing and drainage.

So too with cases of infection of the pelvic peritoneum occurring in the male—such, for instance, as the production of false passages between the bladder and rectum, and involving the recto-vesical pouch of peritoneum at the hands of careless or unskilful practitioners. In one case of this kind I opened the abdominal cavity and found the pelvis the seat of what was evidently a virulently infective inflammatory process, yet the latter was absolutely confined to the pelvis, although but few limiting adhesions were present, and these of the flimsiest character. Sufficient time had elapsed, and ample opportunity had been afforded for spread of the infection to the peritoneum, yet this had not occurred. Certainly the local symptoms possessed a gravity out of all proportion to the general symptoms present in the case.



I turn now to the cases in which opportunities for the invasion of the pelvic peritoneum by the most indubitably virulent micro-organisms, such as those escaping from the intestinal canal, are afforded. This mode and character of infection are perhaps exemplified more frequently in cases of appendicitis in which the organ points downward into the pelvis, and in which early perforative ulceration or gangrene leads to the escape of the contents of the organ. It not infrequently happens, in tracing the appendix into the pelvis, that the latter is brought up to view either perforated or gangrenous, this being followed by a gush of sero-purulent fluid, or, as sometimes happens, the presence of the latter is discovered only by passing gauze grasped in a long forceps into the depths of the pelvis; and then follows the removal of quantities of this septic fluid by the same means. I have thus removed astonishingly large quantities of this material, and yet the patient's condition, either general or local, gave not the least suggestion beforehand that such a condition would be encountered. And, unfortunately, in some of these cases the manipulations incident to the removal of the fluid has led to infection of the peritoneum above the pelvis in spite of every effort to prevent this, with the result of loss of the patient's life from diffuse septic peritonitis, the infecting material coming into contact with the general peritoneum notwithstanding every precaution of walling off the latter with a large number of gauze compresses.

It was during the after-treatment of a case of diffuse septic peritonitis the result of early perforation of a violently inflamed appendix directly into the peritoneal cavity and between the coils of small intestine, and in which I had placed a glass drain as well as a number of wick drains deep in the pelvis, that the line of thought above expressed occupied my mind. My assistant, Dr. R. S. Fowler, had been in the habit of treating cases of vomiting following etherization by raising the head of the bed as high as possible consistent with comfort, thus bringing the force of gravity to bear in facilitating normal peristalsis. In view of the favorable course which the case then in hand was pursuing, it was determined to adopt this as a routine procedure

for the purpose of facilitating the passage of septic fluids from the general peritoneal cavity to that of the pelvis, where, according to the reasoning above outlined, it would do but little harm, comparatively speaking, and from which locality it could be more readily removed by drainage methods. This has been done, and a further experience with the method seems to bear out the favorable opinion first entertained of this measure as of value in aiding to combat the mortality in this much-dreaded condition.

The angle assumed has varied somewhat, but I insist that the elevation of the bed from the horizontal shall be at least from twelve to fifteen inches. In order to prevent the patient from sliding down in the bed a large pillow is placed folded beneath the flexed knees, and upon this the buttocks rest. The pillow is prevented from sliding by a piece of stout bandage passed through at the folded portion and secured to the sides of the bedstead.

The following is a list of the cases consecutively treated by this method to date:

Case I.—October 17, 1899; Brooklyn Hospital. Diffuse septic peritonitis from a combined appendicular and adnexal lesion, originating, in all probability, in the appendix. The accessible parts of the cavity of the peritoneum were treated with equal parts of peroxide of hydrogen and saturated solution of bicarbonate of sodium, which was finally flushed away with decinormal saline solution, after which the abdominal cavity was dried out as thoroughly as possible. Two glass drains were placed in the pelvis and wicking drains inserted in these. The drainage tubes were dressed separately from the abdominal wound.

After-treatment: The head of the bed was raised and kept so for seventy-two hours. The glass tubes were cleared every two hours by aspirating their accumulated contents by means of a long pipette. Copious saline enemata were given, with the usual stimulating treatment, consisting of sulphate of strychnine and citrate of caffeine. The glass drains were withdrawn on the eighth day, and hemmed gauze strips substituted. Recovery resulted. Bacteriological examination of material taken from the remote upper portion of the peritoneal cavity at operation showed staphylococcus infection.

Case II.—October 23, 1899; Brooklyn Hospital. The patient presented the typical clinical picture of diffuse septic peritonitis, with a history pointing to perforative appendicitis as the cause. No hope was held out for recovery, and I hesitated about operating at all. The operation revealed a perforated appendix lying free in the peritoneal cavity and a large quantity of foul-smelling sero-pus. The abdominal cavity was flushed with the peroxide of hydrogen and bicarbonate of sodium solutions, finally washed away with decinormal saline solution. The abdominal cavity was dried out, and combined glass and wicking drains were placed in the pelvis.

After-treatment: The head of the bed was raised. The tube was cleared of its contents every hour for the first six hours, then every two hours. Saline enemata, one pint, were given every hour as long as the rectum was tolerant. The ice coil was applied for relief of pain. Sulphate of strychnine in gr.  $\frac{1}{10}$  doses was given every three hours. There was no vomiting until the third day, when the head of the bed was lowered; in a short time the passage of flatus, which had occurred at intervals previously, ceased, and vomiting occurred. The latter was at first bile-stained, but with rapid distention it soon became fecal. Through a misunderstanding the head of the bed was not raised again for twelve hours, at the end of which time, following a return to the elevated head and trunk posture, improvement in the symptoms commenced and was steadily progressive, so that at the end of another twelve hours the patient expressed himself as feeling comfortable. Owing to the delay in the bacteriological report antistreptococcic serum was employed for the first three days, but this did not seem to exert any influence. The glass and wick drains were removed on the tenth day. Right-sided phlebitis of the saphenous vein developed on the nineteenth day. The head of the bed was kept elevated for three weeks. Staphylococcus growth was identified. The patient recovered.

The phlebitis which occurred in this case may have been due to the increased difficulty experienced by the return circulation owing to the unnecessarily prolonged elevated head and trunk posture. Sonnenburg, who has called attention to the complication of phlebitis of the veins of the lower extremity following

abdominal section, advises raising the foot of the bed as a prophylactic measure.

Case III.—October 31, 1899; Brooklyn Hospital. Operation by my assistant, Dr. Russell S. Fowler; recurrent appendicitis, with diffuse septic peritonitis. The abdomen was distended and rigid, and no gas had passed for thirty-two hours. The appendix, gangrenous throughout and perforated at the tip, and containing an enterolith as large in diameter as the thumb nail, was found lying against the caecal wall, which was likewise gangrenous. The appendix was removed and the gangrenous spot on the bowel wall enclosed in Lembert suture. A large quantity of foul-smelling pus and sero-purulent material was scattered through the peritoneal cavity. Cultures were taken from distant portions of the latter. The cavity was sponged thoroughly with dry gauze, and twenty-one wick drains were disposed throughout the cavity of the peritoneum, including the pelvis, and led out of the operation wound. After-treatment consisted in raising the head of the bed, saline enemas every hour, and large doses of strychnine. The amount of fluid which flowed from the drains during the first twenty-four hours soaked the dressings copiously, the patient's clothing, and the bed. The distention showed marked decrease within twenty-four hours, and gas passed per rectum freely and frequently. The temperature reached normal on the third day and remained so. All drains were removed by the eighth day. Both lower extremities were massaged daily to prevent blood stasis and consequent phlebitis. Bacteriological examination showed both staphylococcus and streptococcus infections, the latter predominating.

Case IV.—December 7, 1899; German Hospital. The patient was admitted with perforative peritonitis of appendicular origin, and presenting the typical picture of diffuse peritoneal inflammation. Upon opening the abdomen free sero-pus was found to be present. The peritoneum was of a dusky cherry-red color as far as could be seen in all directions, and the coils of intestine were greatly distended and covered in places with lymph. The appendix was gangrenous and perforated. The peritoneum of the abdominal and pelvic cavities was sponged clean with simple

sterile gauze and all lymph deposits were removed. Gauze-drainage strips were placed in different directions, including a large drain of the same material into the pelvis, and led out of the abdominal wound.

After-treatment: The head of the bed was elevated and kept so for six days. Fluids were given *ad libitum*, as soon as the patient recovered from the anesthetic, and of these he partook freely. There was no vomiting. Distention rapidly disappeared, gas passed per rectum, and the patient was practically beyond the period of anxiety by the fifth day. The drainage strips were removed in stages, a strip being removed each day, that from the pelvis being the last; they were all out by the eighth day. During the first three days the amount of fluid removed by the drains from the peritoneal cavity, as represented by the soaked dressings and bed, was enormous. Recovery followed. No bacterial examination was made.

Comment: This patient received scarcely any medication, the main reliance being placed upon drainage, posture, and the free ingestion of fluids. The latter was made possible by the absence of vomiting after the operation, although this had been a distressing feature before the abdomen was opened. The removal of large quantities of fluid from the peritoneal cavity through the medium of the drains was a pronounced feature of this case. I have always looked upon this as being exceedingly favorable from the prognostic standpoint. This seems to be borne out by the observation that cells suspended in fluid cannot act so vigorously as when localized in the endothelial surface, and hence cannot, when so suspended, destroy so many bacteria, not only on account of the lessened chance of encountering the bacteria, but because the latter are not so liable to adhere to the cells. With the withdrawal of the fluid the cells reach the endothelial surface, where they assert their aggressiveness upon the bacteria by their own power of movement (*vide supra*).

Case V.—December 13, 1899; German Hospital. The patient was admitted with peritonic facies, distended and rigid abdomen, with a history of a two-days' illness and symptoms pointing to appendicitis. The onset of the attack had occurred

while the patient was on her knees scrubbing the floor. No previous history pointing to the existence of a tumor or of menstrual disturbances was obtained. The operation revealed a diffuse septic peritonitis with evidence of recent rupture of an ovarian cystoma, the chocolate-colored fluid from which had invaded the cavity of the peritoneum above the pelvis. This was carefully wiped away as far as possible with dry sterile gauze, and two glass drains with wicking inserted were placed in the pelvis.

After-treatment: The head of the bed was elevated; strychnine and citrate of caffeine were given in moderate doses, with hourly enemas of saline solution. The tube was cleared by the aspirating pipette every two hours, and from a half ounce to two ounces of dark colored serum was removed each time. There was no vomiting. Rapid improvement followed. Gas passed within six hours. The tubes were removed and replaced by gauze strips on the fifth day. Recovery was uneventful. No bacteriological examination was made.

Comment: In a case bearing a remarkable resemblance to the one narrated in all respects, which came under my care shortly before I commenced the postural feature of the after-treatment, and in which every detail of the treatment was identically the same with the exception of the elevated head and trunk position, death took place on the fifth day from steady and progressive advance of the disease and general septic infection. In fact, I have always looked with much apprehension upon cases of this character, in which the rather heavy and chocolate-colored contents of an ovarian cystoma have escaped into the general peritoneal cavity. This case will be referred to later in this paper.

Case VI.—December 15, 1899. The patient was admitted to my service at the German Hospital with a perforative peritonitis of appendicular origin. Distention and general rigidity were marked. Operation by my assistant, Dr. R. S. Fowler, revealed a perforated appendix lying free in the peritoneal cavity, and a diffuse septic peritonitis present. The peritoneum, as far as could be determined by the incision, was deeply reddened.

The intestinal coils were covered in patches with lymph and greatly distended. There was a large quantity of free sero-purulent material in the cavity of the peritoneum. The abdominal cavity was sponged dry with sterile gauze, and all lymph deposits were removed. Numerous strips of iodoform gauze were placed in different parts of the abdominal cavity and pelvis, and led out of the operation wound.

After-treatment: The head of the bed was raised and left so for three days. Saline enemas were given to the extent of their toleration by the rectum, and fluids were administered freely, with moderate stimulation by means of strychnine and citrate of caffeine. The drains were removed singly and upon separate days; the last was removed on the sixth day. Recovery followed. There was no bacteriological examination.

Case VII.—The patient was admitted to my service January 24, 1900, in the German Hospital, with a history of recurring attacks of appendicitis, the last of which came on six days previously. Upon admission the usual anxious expression was visible, with greatly distended and rigid abdomen. Operation was done by my assistant, Dr. R. S. Fowler. The abdomen was opened by an incision placed at the outer edge of the right rectus muscle. Free pus was present in the peritoneal cavity, with the usual widespread and deeply reddened peritoneum. Three distinct abscess cavities were found in addition: one in the neighborhood of the appendix, one just below and extending behind the liver, and a third, containing about sixteen ounces of sero-purulent material, in the pelvis. The first two contained about four ounces each. The appendix was perforated. After excision of the appendix the abscess cavities were emptied and carefully cleansed with gauze wetted with 1:3,000 bichloride solution. The general peritoneal cavity was carefully dried, and gauze drainage strips led from the remote portions of the latter to the operation wound. The abscess cavities were also drained in the same manner.

After-treatment: Elevation of the head of the bed was kept up for five days. Strychnine and citrate of caffeine were given in moderate doses. There was gradual withdrawal of the drains.

No vomiting took place. Fluids were allowed to the extent of the patient's desires in that respect. There was an enormous amount of fluid carried off from the peritoneal cavity by the drains. The patient recovered. No bacteriological examination was made.

Case VIII.—February 27, 1900: Methodist Episcopal Hospital. This was a case of post-operative diffuse septic peritonitis. The patient was operated upon for extensive ventral hernia resulting from an operative attempt to remove a myomatous uterus five years previously. Infection probably resulted from the use of an unusually thick strand of catgut (always difficult of sterilization) in ligating an exceptionally dense adhesion. Symptoms of peritonitis commenced within eight hours of the operation and increased with alarming rapidity until the entire peritoneal cavity was involved. The distribution and tenderness were extreme, the pulse 160 and feeble, and the peritonic facies marked. The head of the bed was raised twelve inches from the horizontal; stimulants were administered (strychnine and caffeine), calomel was given, followed by salines; enemata of lac asafetida were employed, and antistreptococcic serum was given. In spite of all these the alarming symptoms continued until the fourth day, when I accidentally learned that whenever the enemata were given the head of the bed had been lowered and the foot raised, to facilitate the retention of the latter. This had occurred quite frequently for the reason that saline enemata were likewise given in the intervals of giving the lac-asafetida rectal injections. Upon investigation I found that this had been done about every three hours since the commencement of the treatment, the patient remaining in this position on an average of a quarter of an hour each time. The patient's condition at this time was alarming in the extreme. She lay with her eyes half opened and the globes rolled up; the abdomen was barrel-shaped; the pulse was almost imperceptible at the wrist, and the jactitation required the use of morphine. She had complained after each time of raising the foot of the bed of a burning sensation along the esophagus; finally vomiting set in, and she rejected what was given by the mouth. The rectum had finally become in-



tolerant, and her sufferings were extreme. It was at this time that the error was discovered and rectified. The head of the bed was permanently raised, and from this time improvement commenced. Flatus was expelled in copious quantities, and liquid movements of the bowels were obtained. The morphine was stopped, the ice coil being found to be sufficient to relieve the abdominal distress. By the second day following the persistent use of the elevated head and trunk posture her morale had so improved that she greeted me with a smile; the pulse had gradually fallen to 116 and was greatly improved in strength, and she was beyond the stage of anxiety. She finally recovered completely.

Case IX.—March 2, 1900; German Hospital. The patient, a young man aged sixteen years, was admitted with acute appendicitis of two days' standing. In spite of the fact that the attack was comparatively recent, a diffuse septic peritonitis was already under way. The abdomen was board-like and tympanitic, the peritonitic facies was present, and tenderness was extreme. Upon opening the abdomen sero-purulent fluid was found to be present, in which flakes of lymph were floating; the entire tract of the small intestine was intensely reddened, and fibrinous exudate was present. A long perforated appendix lying in the midst of the unprotected small intestines was brought out of the wound and removed. Eventration was then performed, the intestines being laid on the abdominal wall and well covered with gauze compresses, which were frequently wetted with warm saline solution. The immediate region from which the appendix had been removed was treated with two ounces of equal parts of peroxide of hydrogen and a saturated solution of bicarbonate of sodium. No attempt was made to disseminate this throughout the peritoneal cavity; and as much of this was removed as possible by flushing with saline solution, before proceeding further. The abdominal and pelvic cavities were then repeatedly washed out with large quantities of saline solution poured from a pitcher, at least twelve gallons being thus employed. The abdomen was then dried out, and the intestines were returned; a glass drain carrying a strip of iodoform

gauze was placed in the pelvis and dressed separately from the abdominal wound, which was sutured down to the glass drain.

After-treatment: Elevated head and trunk position. Plenty of fluids was allowed, and no medication save small doses of strychnine and caffeine to bridge over the first shock of the operation, which was severe. Aspiration of the glass drainage tube was done every six hours. No vomiting occurred. Small doses of calomel (gr.  $\frac{1}{5}$  every half-hour) were given until two grains had been taken. Normal peristalsis commenced within four hours, resulting in the expulsion of flatus, and liquid stools passed on the second day. Recovery followed. Bacteriological examination of cultures taken from remote portions of the peritoneal cavity showed infection.

Thus it will be seen that, of nine consecutive cases of diffuse septic peritonitis treated by the combined methods of elevated posture and drainage, all have resulted in recovery. I have not included among these several cases in which a spreading peritonitis existed about a focus of infection, as shown by decided redness of the coils of intestine in the neighborhood, and which were apparently arrested by the elevated head and trunk position. I may say, however, that in these cases the convalescence has been rapid, and the patient's condition has seemed to be more comfortable than is usual during the first few hours following the operation, mainly through the absence of vomiting. Because of this, however, and with the object of utilizing the elevated head and trunk posture as a prophylactic measure, I would strongly recommend the latter in all cases of abdominal section, even at the risk, if Sonnenburg's view of the mechanism of the production of phlebitis of the veins of the lower extremity following this operation should prove to be correct, of the occurrence of this complication.

For the purpose of comparison I have taken an equal number of cases of diffuse septic peritonitis occurring in my hospital services, the dates of which embrace a period of time corresponding as nearly as possible to that in which the foregoing were observed, and which were subjected to the same measures of treatment with the exception of the elevated head and trunk

posture. Of these nine cases four patients recovered and five died. These cases were not taken consecutively, nor yet, on the other hand, were they selected cases. Had they been taken consecutively there would have been made a manifestly unfair record to any method of after-treatment, since the group would have included two cases which resulted fatally within twenty-four hours of the operation, and there would have been seven fatal cases out of nine, instead of five. Further investigation of the records does not increase the proportion of recoveries greatly, and, after making all due allowance for those cases which have ended fatally from conditions which destroyed the patient before any plan of after-treatment could have been effective, say within twenty-four hours of the operation, it has been practically impossible to lower the death rate but slightly below fifty per cent. It may likewise be stated, in passing, that the further back the records are searched the higher the mortality becomes.

The record of nine consecutive cases of diffuse septic peritonitis terminating in recovery is extraordinary, not to say startling, and no reasonable surgeon could expect such uniformly good results, even in groups of cases in which milder forms of infection are alone included, and from which patients living less than twenty-four hours are excluded. For it falls to the unhappy lot of every surgeon occasionally to encounter cases in which the deep brown or mahogany color of the intestine indicates a profoundly septic inflammation present in its muscular structures, which no means yet known is capable of successfully combating, and in which the patients even live beyond twenty-four hours. Yet in three cases in this group the infecting organism was identified, and in at least one of these the much-dreaded streptococcus was present. The following is a resumé of the nine cases treated without the addition of the postural feature of the first nine:

Case I.—January 26, 1898; Methodist Episcopal Hospital; acute appendicitis with perforation and diffuse septic peritonitis. Gauze drainage was used. The patient died. No bacteriological examination was made.

Case II.—January 27, 1898; Methodist Episcopal Hospital; acute salpingitis from infection by a uterine sound while under

office treatment by the family physician. Diffuse septic peritonitis was present. Gauze drainage was used. Antistreptococcic serum, with saline infusion, was given. The patient recovered. No bacteriological examination was made.

Case III.—May 23, 1898; Methodist Episcopal Hospital; gangrenous appendicitis and diffuse septic peritonitis. Gauze drainage was used. Recovery took place. No bacteriological examination was made.

Case IV.—March 17, 1899; Methodist Episcopal Hospital; acute appendicitis and diffuse septic peritonitis. The abdomen was cleansed with decinormal salt solution. Flakes of lymph were removed with sterile gauze. Gauze strips for drainage were inserted in the general peritoneal cavity. Recovery took place. No bacteriological examination was made.

Case V.—April 8, 1899; Methodist Episcopal Hospital; acute appendicitis with perforation, and diffuse septic peritonitis. The abdominal cavity was flushed with decinormal salt solution. A glass drain was inserted in the pelvis, and iodoform-strip drains were passed from the abdominal peritoneum to the operation wound. The patient died. No bacteriological examination was made.

Case VI.—September 14, 1899; Brooklyn Hospital; ruptured ovarian cystoma with chocolate-colored contents. Diffuse septic peritonitis was present. Glass drains were inserted in the pelvis and gauze strips from the abdominal cavity to the operation wound. Saline infusion and antistreptococcic serum were used. The patient died. No bacteriological examination was made.

Case VI.—October 28, 1899; Methodist Episcopal Hospital; gangrenous appendicitis; diffuse septic peritonitis. The abdomen was dried out with sterile gauze. Glass drains were used in the pelvis. Recovery resulted. No bacteriological examination was made.

Case VIII.—November 2, 1899; Methodist Episcopal Hospital; acute appendicitis; diffuse septic peritonitis. Iodoform gauze drains were used in the abdominal cavity, and a glass drain in the pelvis. The patient died. No bacteriological examination was made.

The remaining case in this series possesses an especial interest in this connection for the reason that a novel and what may prove upon further trial a valuable addition to present methods was employed. I refer to the plan of securing drainage at the site of the root of the mesentery of the small intestine by a transversely placed rubber drainage tube through the latter, and repeated irrigations through this of large quantities of decinormal saline solution.

Case IX.—February 22, 1900; German Hospital; the patient was admitted with diffuse septic peritonitis of appendicular origin. Operation revealed large quantities of sero-purulent material scattered throughout the general peritoneal cavity, with intestines matted together, pus, and with large patches of lymph. The appendix was violently inflamed, but not perforated. After removal of the appendix eventration was done, the intestines being removed loop by loop, and the coils carefully cleansed and the fibrinous patches removed by carefully wiping with sterile gauze. The intestines were then allowed to rest upon the abdominal wall and carefully covered with towels wrung out of warm salt solution. These were reinforced as to their heat from time to time, and shock from the disembowelling process was thus effectually guarded against. The peritoneal cavity was then flushed with several gallons of warm saline solution. A large rubber drainage tube was then passed through the root of the mesentery of the small intestine at about the middle of the abdominal cavity, and the ends were led out of openings made for the purpose in each flank in such a manner that the tube traversed the abdominal cavity in a transverse direction, being held down in the center by passing through the mesentery. A similar tube was led from behind the liver and spleen, and two from the pelvic cavity, separate openings being made for the passage of these as directly as possible through the abdominal wall. The intestines were then returned to the abdominal cavity, and the operation wound was closed. Saline solution was passed through the upper tubes; this flowed freely from the lower ones.

After-treatment: Strychnine and citrate of caffeine were given

for stimulation, with saline solution and whiskey by the rectum. Irrigation of peritoneal cavity through the tubes was done with a gallon of saline solution at 100°F. every six hours. With each irrigation gas passed freely per rectum. The distention subsided, vomiting ceased, and several spontaneous evacuations of fluid faeces took place. At the commencement of each irrigation seance, the fluid came through the lower tubes turbid, but before the gallon of irrigating fluid was exhausted it became clear. The general septic symptoms from which the patient was suffering when admitted, however, steadily progressed; she became delirious, and death took place from septicaemia thirty-six hours after the operation. No bacteriological examination was made.

I am aware that there are several sources of fallacy in estimating the value of conclusions drawn from the study of any method of treating diseases of bacterial origin, and the relation which the method bears to the results in any group of cases. Briefly, these fallacies have their origin in the relation which the following factors in the individual case bear to the result: (1) The pyogenic properties of the infecting agent; (2) the number of organisms present; (3) the susceptibility of the individual; (4) the inhibitory influences sometimes exerted by the peritoneal fluids upon micro-organisms. Elimination of the first of these, namely, the pyogenic properties of the infecting agent, is possible to a certain extent by proper bacteriological examination. The second, the number of organisms present, is capable of elimination only within certain limits, such, for instance, as the statement that the fluids were "swarming with bacteria," that the latter were present in "moderate quantities," or that "but few were found." But how shall we estimate the degree of susceptibility of the patients who perished, or the influences exerted by an immunity present in those who survived? To this individual factor of vital resistance are to be ascribed many of the discrepancies in results in groups of cases as they are presented, and which vitiate more than anything else statistics as they relate to different plans of treatment as advocated. This relates not only to the local susceptibility to infection and its spread, but to the general susceptibility as well. Yet the individual

may possess an immunity to infection entirely independent of the factor of vital resistance. While it is true as a general proposition that those greatly depressed physically are more liable to perish from suddenly developed infectious processes, whether or not the latter is made possible by an operative procedure, it is likewise true that some individuals possess a decided immunity to infection entirely independent of any apparent high grade of physical condition on the one hand, while others exhibit a susceptibility altogether disproportionate to previously existing active or actually debilitating influences on the other hand.

A word as to the conditions present in the cases that have been denominated "diffuse septic peritonitis." It has been my happy lot to meet occasionally with conditions in which large quantities of opaque milky material, consisting of desquamated endothelial cells, leucocytes, and perhaps other cell forms floating about in a copiously transuded peritoneal fluid, have been found present in the general abdominal cavity, unaccompanied by any signs of peritonitis, the patients' recovery following as if such fluid had not been present. In these instances the fluid has been found as to its infective qualities to be insufficient to produce more than enough irritation to lead to an increased quantity of secretion of the peritoneum and to add some turbidity to the latter as described, the inhibitory or even destructive powers of the peritoneal fluids to the micro-organisms accounting for the sterility and consequent failure of infection. These have not been classed as cases of peritonitis. But when all peritoneal structures, both parietal and visceral, within sight from an ordinary abdominal section are observed to have exchanged their pearly pink color for a decided red or bluish-red, and particularly if this condition extends to the mesenteric folds of the small intestine, and patches of fibrin and pus cling to the surface of the latter, there can be no question as to the propriety of designating such a case as one of diffuse septic peritonitis.

If asked what, in my opinion, is the best general line of treatment for diffuse septic peritonitis as found to exist upon opening the peritoneal cavity, I might hesitate to express myself as being either for or against eventration or disembowelling for

purposes of methodical cleansing; as well as the employment of peroxide of hydrogen solution, or the use of large quantities of decinormal saline solution for the purposes of flushing out the peritoneal cavity. But there are two points upon which I would not hesitate to speak with confidence, namely, the employment of the elevated head and trunk position, and drainage of the pelvic cavity at least by means of properly placed and protected glass drains. I offer this as a method preferable to Clark's position, which is the exact reverse of this treatment, and I do it with the full knowledge of the alleged anatomical and physiological reasons advanced in support of the last-named method. Clark's position certainly does not empty the pelvic cavity of septic fluid, for the extent to which the patient must be inverted to accomplish this is incompatible with safety, or with his comfort to say the least, since practically he must be placed standing on his head. This was demonstrated by Dr. Eastman, the resident pathologist at the Brooklyn Hospital, in a series of experiments performed upon cadavers at my request. It is fortunate for those patients who have recovered under this treatment (and I might have said, in spite of this treatment) that this is true, for the reason that this would not only lead to a still further spread of septic fluids through the intestinal region of the peritoneal cavity, of itself a sufficiently dangerous area from the infective standpoint, but the septic fluids from the pelvis would finally reach the exceedingly dangerous infective area of the diaphragm, particularly the central tendinous portion of the latter, with its large lymph trunks and numerous stomata, which rapidly absorb blood, pus, and in fact fluid of whatever sort, with its contained bacteria and toxic debris, instead of being allowed to remain in or flow to the pelvic cavity, in the peritoneum of which are found but very few lymph trunks and stomata, and the capillary lymphatics of which soon become obstructed by lymph thrombi which prevent further spread of infectious material. For with the involvement of these lymph vessels the function of the latter is destroyed by the obstruction caused by thrombi, this constituting the method by which further invasion of peritoneum is prevented and the organism itself



protected as well. Under these circumstances transference of the septic fluids from the most dangerous areas of the enormous lymph sac constituting the peritoneal cavity to its least dangerous region, namely, the pelvic portion thereof, and in the case of operative attacks removing these from the latter by properly placed and protected means of drainage, constitute not only a rational but an imperatively demanded procedure.

THE END



# Diffuse Septic Peritonitis and the Elevated Head and Trunk Posture. A Report of Three Additional Consecutive Cases of Recovery

BY

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**T**HE following is presented as an addendum to the report of nine consecutive cases of recovery of diffuse septic peritonitis published in the Medical Record for April 14th, thus making twelve consecutive cases in which recovery has taken place under the combined treatment of cleansing the neighborhood of the original focus with hydrogen peroxide, thorough flushing of the abdomen with decinormal saline solution at 110°F., deep pelvic drainage, and the elevated head and trunk posture to facilitate the passage of fluids from the intestinal and diaphragmatic areas to the pelvic portion of the peritoneum. The special object to be accomplished by this posture, namely, that of removing the fluids from the dangerous areas mentioned to the comparatively safe region of the pelvis, together with the anatomical and physiological reasoning upon which this is based, are fully set forth in the article referred to.

Case X.—March 15, 1900; Methodist Episcopal Hospital; female, aged seven years. The patient was admitted and operated upon on the tenth day of an attack of acute appendicitis. The expression was anxious. There were extreme abdominal distention and tenderness, with persistent vomiting. The conditions were believed to be complicated with intestinal obstruction of mechanical origin. A median incision was made, the operation revealed the small intestines deeply reddened and matted together with exudate; as these were separated large quantities of sero-purulent material flooded the peritoneal cavity. The appendix was gangrenous and perforated. It was excised; the primary focus was cleansed with partially neutralized hydrogen peroxide (diluted with equal parts of a saturated solution of sodium bicarbonate). The intestines were separated, cleared of lymph deposits wherever these were easily separable, and the peritoneal cavity was repeatedly flushed with large quantities of decinormal saline solution. A glass drainage tube was placed in the pelvis and led out of the lower angle of the incision.

After-treatment consisted of elevation of the head of the bed fifteen inches above the horizontal; an enema of saline solution every two hours. Vomiting ceased; flatus passed freely; the distention subsided. The glass drainage tube was removed on the sixth day, and substituted, on account of a reaccumulation in the pelvis, by one of rubber, which was finally removed on the fourteenth day. The head of the bed was lowered at the end of the second week. Recovery resulted.

Case XI.—March 17, 1900; German Hospital; male, aged twenty-three years; perforative peritonitis of appendicular origin. The operation showed a large quantity of sero-purulent fluid; the peritoneum was deeply reddened, and extensive deposits of fibrino-plastic material were scattered over the entire area of the small intestine. The appendix was excised; the original septic focus was cleansed with partially neutralized peroxide-of-hydrogen solution; the lymph deposits were removed where easily detachable; the peritoneal cavity was flushed with decinormal saline solution at 110°F.; a glass drain was inserted in the pelvis.

After-treatment: The head of bed was elevated fifteen inches;

stimulation with strychnine and caffeine; an enema of decinormal saline solution was given every two hours; fluids were administered by mouth *ad libitum*. No vomiting occurred after the patient was placed in bed. Flatus passed freely after six hours. The glass drain was forced out by an act of coughing at the end of twenty-four hours; it was not replaced. The elevated head and trunk position was maintained for six days. Staphylococcus was found in culture. Recovery resulted.

Case XII.—April 5, 1900; Methodist Episcopal Hospital; male, aged sixty-six years; perforative peritonitis of appendicular origin. Upon admission the patient presented the characteristic picture of diffuse septic peritonitis. Upon opening the abdomen, a quantity of sero-purulent fluid escaped from the peritoneal cavity. The intestinal coils were greatly distended, deeply reddened and mottled, and coated here and there with patches of fibrino-plastic exudate. It was with difficulty that spontaneous eventration through the abdominal wound was prevented. The appendix was perforated. Excision of the appendix was done; the original septic focus was cleansed with partially neutralized hydrogen dioxide; the peritoneal cavity was systematically flushed with decinormal saline solution. A quantity of the latter was permitted to remain in the cavity for the purpose of favoring peritoneal leucocytosis and immunity. A small supplementary opening was made through the abdominal wall in the left linea semilunaris, and through this a large and closely fitting glass drainage tube was passed to the bottom of the pelvis. The original operation wound was closed.

After-treatment: Elevation of the head of the bed eighteen inches; stimulation by strychnine and caffeine; aspiration of drainage tube every four hours; enemata of decinormal saline solution. Nausea and vomiting ceased at once; normal peristalsis was re-established and flatus expelled within twelve hours; a movement of the bowels was obtained by simple enema on the morning of the third day. The rigidity of the abdominal wall was replaced by the normal relaxed condition, and the peritonitic facies disappeared. The glass drain was removed on the fourth day, and its place supplied by a narrow gauze strip. Recovery ensued.

The following case is offered in addition. Especial points of interest present themselves in the case, for the reason that the abdominal symptoms absolutely disappeared, while a general septico-pyæmia persisted, which finally resulted in septic meningitis, from which the patient died on the thirteenth day following the operation. I am greatly indebted to Dr. H. A. Henriques, of Morristown, N. J., who, although not previously in attendance, assumed the care of the patient at my request, upon the supervision of the meningeal complication.

April 14, 1900; L. D——, aged fourteen years, of Morristown, N. J.; perforative appendicitis: third day of the disease. The patient presented the typical appearances of diffuse septic peritonitis, i.e., anxious facial expression, purplish-red hue of surface (vaso-motor paralysis), extreme distention, and rigid abdominal walls (barrel-shaped abdomen). There was paralysis of peristalsis. The stomach was absolutely intolerant; vomiting of brownish-green matter took place. The pulse was 160; temperature, 104°F. Abdominal section revealed deeply reddened coils of intestine floating about in a large amount of foul-smelling sero-purulent fluid with flakes of lymph; fibrino-plastic patches were present upon the intestinal serous surfaces. The appendix was gangrenous and perforated. Excision of the appendix was done; the region of the original focus of infection was cleansed with hydrogen dioxide undiluted, about twelve ounces being used. Considerable of the hydrogen-dioxide solution necessarily invaded the general peritoneal cavity. Forcible flushing was done with decinormal saline solution at 110°F. A large glass drainage tube was inserted at the bottom of the pelvis.

After-treatment: Elevated head and trunk posture; the glass drainage tube was aspirated every three hours until the third day, when it was removed, and a rubber drainage tube and a strip of iodoform gauze were substituted. Stimulation was effected by caffeine and strychnine. A saline enema was given every three hours; fluids *ad libitum*. The nausea and vomiting ceased at once. The bowels moved spontaneously three times within the first twelve hours, accompanied by the expulsion of large quantities of gas; the distention promptly diminished. The

morale rapidly improved. The extensive general septic conditions which existed prior to the operation, however, persisted, although the abdominal symptoms rapidly subsided, save the occurrence of a small and well-walled-off secondary abscess in the left iliac region, which was evacuated by an incision in the left linea semilunaris on the ninth day. On the eleventh day symptoms of cerebral meningitis developed, with intolerance of light, vomiting, high fever, delirium, the temperature finally reaching 107.5°F.; there was stiffness of the neck due to contractions of the posterior muscles; alternate contraction and dilatation of the pupils occurred. The patient became comatose and remained so for forty-eight hours preceding the final lethal exit, which took place on the thirteenth day following the operation.

A word as to the method of flushing pursued in the last case: I believe, in spite of the assertion of Bode to the contrary, that eventration or disembowelling adds increased risks to the operative procedure, and should be avoided, if possible. Heretofore the difficulty of reaching every portion of the peritoneal cavity with the irrigating-fluid and with the intestines *in situ* has been almost insurmountable. In the last case, I adopted an expedient for overcoming this difficulty by means of the following improvised means: The outlet tube of a large douche bag was cut away, and through the hole thus left in the bottom of the bag an ordinary curved and flanged abdominal glass drainage tube of large size was passed from inside the bag. The tube was then passed into the remoter portions of the peritoneal cavity at first, and the bag being filled with the decinormal saline solution, the solution was forced from the bag by rolling the latter upon itself from above downward, the fluid rushing rapidly and forcibly from the end of the glass tube as this was moved about first in the region of the spleen and liver, and subsequently between the coils of intestine and about the root of the mesentery. Quantities of sero-purulent material, with flakes of lymph, were thus brought to the surface and flowed out of the operation wound with the returning fluid. The pelvic cavity was then flushed in a like manner, and finally a rapid washing away of what debris had been deposited about the wound itself followed. The bag was filled and then emptied

again and again, until about eight gallons of the decinormal saline solution was used.

Finally, I desire to state that, in spite of the fact that the elevated head and trunk posture should, theoretically, throw additional work upon the heart in these desperate cases, this has not constituted a valid objection to its employment, in my experience. In case the patient fails to respond to the stimulation employed after the operation, however, there would be no objection to placing the bed in the horizontal position, or even elevating the foot of the bed during the first few hours, providing thorough cleansing of the peritoneal cavity had been done. Absorption of the relatively clean saline solution from the diaphragmatic and intestinal areas will do no harm, and may be of service in assisting the stimulation of the patient. A further argument in this connection is found in the fact that the presence of the saline solution in the peritoneal cavity favors a large local leucocytosis, which, according to the experiments of Durham and Issaeff, results in a peritoneal immunity against pathogenic bacteria for a certain length of time. Unless persistent and progressive failure of the circulation is observed in spite of strychnine and caffeine stimulation combined with whiskey and saline enemas, however, it is better to place the patient in the elevated head and trunk posture from the commencement, since, in addition to its principal advantage, this posture secures early cessation of vomiting and the prompt expulsion of flatus.

THE END







A. J. OCHSNER  
[1858-1925]

# Albert John Ochsner

## BIOGRAPHY

- 1858 Born April 3, in Baraboo, Sauk County, Wisconsin, son of Henry and Judith (Hottinger) Ochsner. His father was county treasurer and at the end of his term of office returned with his family to the homestead and farm at Honey Creek where Albert grew up. He attended school for five months of the winter and worked on the farm at other times.
- 1874 Age 16. Sent to school in Baraboo for two years.
- 1876 Age 18. After passing the county teachers' examination he taught rural school for five months each year during the following three years.
- 1879 Age 21. Entered the high school at Sauk Creek.
- 1880 Age 22. Became principal of a graded school at Ironton, Wisconsin.
- 1884 Age 26. Received degree of B.Sc. from University of Wisconsin, having completed the four years' work in three.
- 1886 Age 28. Received M.D. degree from Rush Medical College. Interned for one year at Presbyterian Hospital in Chicago. During internship, spent nine months in Europe where he studied under Kolisko and Paltauf, pathologists, and Billroth, surgeon. On his way to America in the fall he stopped in London to take an examination before a committee of the Royal Microscopical Society, receiving the degree of F.R.M.S. He returned to Chicago to finish his internship and to give a course in microscopy at Rush.
- 1888 Age 30. On April 3 married Marion H. Mitchell of Chi-

cago and again left for study in Europe, especially at "the clinics of Profs. Billroth, Albert and Braun in Vienna, Krönlein in Zurich, v. Bergmann, Hahn, Bardeleben, Olshausen and Martin in Berlin and Schede in Hamburg." In the fall, Ochsner returned to Chicago and engaged in private practice for several years, meanwhile working in the surgical clinic at the Rush Medical College and becoming an assistant to his former teacher, Dr. C. T. Parkes.

- 1889 Age 31. Instructor in surgery at Rush Medical College.
- 1891 Age 33. Became Chief Surgeon to Augustana Hospital.
- 1896 Age 38. Became Chief Surgeon to St. Mary's Hospital.
- 1900 Age 42. Professor of clinical surgery in Medical Department of University of Illinois until 1925. Chairman of Section on Surgery of American Medical Association.
- 1908 Age 50. First lieutenant in United States Medical Reserve Corps.
- 1909 Age 51. Received degree of LL.D. from University of Wisconsin.
- 1910 Age 52. President of Clinical Congress of Surgeons of North America.
- 1913 Age 55. A founder of the American College of Surgeons.
- 1916 Age 58. Major in United States Medical Reserve Corps.
- 1923 Age 65. President of American College of Surgeons.
- 1924 Age 66. President of American Surgical Association.
- 1925 Age 67. Stricken July 21 with angina pectoris, but he performed several operations on July 23. Died on July 25 at his home in Chicago. Buried at Honey Creek, Wisconsin.

Member of Southern Surgical and Gynecological Society.  
 Member of American Medical Association.  
 Member of Illinois State Medical Society.  
 Member of Chicago Medical Society.  
 Member of Chicago Pathological Society.  
 Member of Chicago Surgical Society.  
 Member of International Society of Surgeons.

Fellow Royal Microscopical Society of England.

Honorary Fellow, Royal College of Surgeons of Ireland.

Honorary member, National Academy of Medicine of Mexico.

Honorary member, National Surgical Society of the Republic of Switzerland.

Honorary member, Medical Society of Stockholm.

Member of editorial staff, Surgery, Gynecology and Obstetrics.

Dr. Ochsner was a familiar figure at all medical conferences and congresses. His striking personality and appearance and the invariable wearing of the white standing collar and white linen tie made him especially conspicuous. (Obituary in J. Am. M. Ass., 85: 374, 1925.)

He spent two weeks every three months at various surgical clinics in the United States, from 1895 to 1907.

### EPONYMS

1. INCISION—The midline incision of Ochsner and Perry.
2. MUSCLE—lies just below common duct in duodenum, near junction of second and third portions of duodenum.
3. RING—a ring of mucous membrane around the opening of the pancreatic duct.
4. SOLUTION—carbolic acid 0.5%, aqueous saturated solution of boric acid 66%, alcohol 33%.
5. TREATMENT—of appendicitis by securing peristaltic rest so that peritoneal adhesions may form; abstention from food by mouth, no purgatives, gastric lavage, rectal feedings and Fowler's elevated head position.

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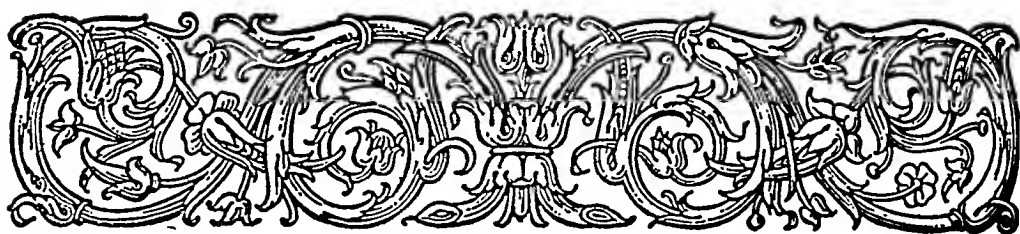
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## The Cause of Diffuse Peritonitis Complicating Appendicitis and Its Prevention

Chairman's address, delivered before the Section on Surgery and Anatomy, at the Fifty-Second Annual Meeting of the A. M. A. at St. Paul, Minn., June 4-7, 1901

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**E**VERY surgeon who treats patients suffering from acute appendicitis must be impressed with the fact that an unfavorable outcome in any given case means that the infection which was originally confined to the small space occupied by the vermiform appendix itself has first invaded the tissues immediately surrounding this organ and has then been distributed over the entire peritoneal cavity. In other words, in fatal cases the patient practically always dies as the result of a diffuse peritonitis.

Other conditions may arise which may result in a fatal issue. There may be a septic thrombosis of the vessels in the vicinity of the appendix or an empyema, or even pyemia, but by far the greatest number of deaths occurs from diffuse peritonitis, and if it is possible to prevent this, the mortality from appendicitis must at once fall enormously. In order to plan a means for the prevention of this condition, it is well to study the progress of the disease from its onset.

There is danger of the occurrence of diffuse peritonitis in the following classes of cases: 1, in gangrenous appendicitis; 2, in perforative appendicitis; 3, in cases of which the cecal end

of the lumen of the appendix is closed and the distal portion so thoroughly distended with septic material as to make its walls permeable to micro-organisms; 4, in the very rare cases in which there are small abscesses in the walls of the appendix not directly connected with its lumen, and 5, in cases in which there is a septic thrombosis of some of the vessels, but not sufficient to cause gangrene.

The first, second and third conditions are so common that every surgeon who operates frequently during the acute attack has seen them many times.

Were it possible to keep the septic material in these cases within the circumscribed area in which it occurs primarily, it is plain that the condition would remain comparatively harmless.

#### ANATOMICAL CONDITIONS INVOLVED

The appendix is virtually surrounded on all sides excepting in the direction of the median line by relatively fixed tissues. Above we find the lower end of the cecum and the cecal end of the ileum; to the right and in front is the parietal peritoneum; behind the peritoneum covering the iliacus muscle, and toward the median line it is surrounded by loops of small intestines. Moreover, the omentum extends far beyond its lower end.

It is true that the appendix may be displaced downward, but in this case it will again be surrounded by fixed tissues which seem especially adapted to dispose of septic material. Again in this case there is an enteroptosis affecting the cecum, and always with this a marked lowering of the transverse colon and stomach and with these the omentum.

Thus we see that the natural anatomical arrangement for the protection of the general peritoneal cavity is extremely efficient. There is but one weak point in the anatomical provision for this protection, namely, in the direction of the median line, because the great mobility of the small intestines naturally favors the distribution of septic material to all parts of the peritoneal cavity.

If we can prevent the small intestines from doing harm in this direction, we will have accomplished our end, theoretically at least.

At this point I wish to direct your attention to another important anatomical condition. The blood supply of the omentum is so enormous that it will readily dispose of a very severe infection by walling off the surrounding structures if it is permitted to give its physiological attention to a single area.

It is a well-known fact which every one who frequently operates during the acute attack of appendicitis has had many opportunities to observe, that the omentum crowds itself about any inflammatory or traumatic lesion within the peritoneal cavity the moment the latter occurs, and if left undisturbed, a few hours will suffice to cause efficient protective adhesions.

These adhesions become stronger every hour and the blood supply in the omentum becomes greater, so that if no disturbance arises one can reasonably expect efficient protection to the general peritoneal cavity from the omentum.

Another important fact must not be lost sight of in this connection. The fact that the surrounding structures are relatively fixed in position favors the condition of rest of the inflamed part and permits the omentum to act after the manner of a splint applied to an inflamed joint. The value of rest as a preventive to the extension of an infection in any part of the body cannot be over-estimated. Consequently if it is possible for us to secure this condition of rest we have gained another important point in the right direction.

In case the appendix is displaced upwards its position is even more favorable, because the available amount of omentum is thus increased. Again, if the appendix is retrocecal in its position, which is very frequently the case, the infection of the general peritoneal cavity is more easily prevented than when in its normal location. If anteriorly misplaced, it is likely to be fastened to the anterior abdominal wall by the adherent omentum.

#### PERISTALTIC MOTION OF THE SMALL INTESTINES

It is plain, then, that the infection of the general peritoneal cavity must occur from a disturbance on the part of the small intestines, and must be due to their peristaltic motion.

It is significant that in almost all cases of severe acute appendicitis the obstruction to the passage of gas and intestinal contents through the ileo-cecal valve is one of the early symptoms. Nature is trying to prevent this very dangerous disturbance by closure of the ileo-cecal valve. We have a condition corresponding to the contraction of the muscles surrounding an inflamed joint, to the closure of the eyelids in conjunctivitis, etc. Moreover, the muscles overlying the appendix become tense. Everything tends toward the establishment of conditions of rest in the vicinity of the inflamed organ.

#### THE EFFECT OF THE INTRODUCTION OF ANY KIND OF FOOD OR CATHARTIC INTO THE STOMACH

It is a fact which has been demonstrated a great number of times that peristalsis does not occur unless food or cathartics are introduced into the stomach. If the attack occurs shortly after a meal and before all of the food has passed through the ileo-cecal valve, its presence may cause peristaltic motion in the small intestines. Upon reaching the ileo-cecal valve the latter may prevent its passage into the cecum, causing return peristalsis, and the intestinal contents are forced back into the stomach, whence it may be expelled by vomiting or be again forced into the small intestine, giving rise to further peristaltic motion. Moreover, it will give rise to the formation of gas, which must cause disturbance and pain in its attempt to pass the ileo-cecal valve.

This motion, it is plain, will be harmful primarily from the fact that it gives rise to pain by disturbing the sensitive inflamed tissues; and secondarily from its likelihood of carrying infectious material with which it has come in contact in the vicinity of the inflamed appendix to other parts of the peritoneal cavity.

Besides this the physiological attention of the omentum can now no longer be directed to the single area of infection, because other parts of the peritoneal cavity require its protection, and such portions of the omentum as are not yet thoroughly adherent about the inflamed appendix are likely to be diverted from this point.

Theoretically, then, the disturbance which is to be feared to so great an extent is caused by the presence of food or cathartics in the stomach, and its logical remedy would be to absolutely prevent the introduction of any form of food or cathartics into the stomach and the removal by gastric lavage of any portion of food which may be retained in the stomach at the beginning of an attack. It may be necessary to perform gastric lavage twice or at most three times in order to entirely remove remnants of food which may have regurgitated into the stomach from the small intestines by reason of return peristalsis.

That this is not only true theoretically, but also in practice, I have demonstrated in a large number of cases; and many other surgeons who have followed the same plan of treatment have informed me of the fact that their experience has agreed with mine.

It is true that a few surgeons have reported failures with this method, but an investigation of their treatment in each instance has shown that they disregarded one of the three cardinal points in the treatment. They either gave just a little liquid food by mouth, or they gave some form of cathartics, or disturbed the rest of the intestines by giving large enemata, or they neglected removing the stomach contents by gastric lavage.

Of course, the slightest amount of food is sufficient to start peristaltic motion of the small intestines, and the same is true of cathartics, and consequently if either of these features in the treatment is omitted one cannot hope for the same results.

It does not matter what form of appendicitis may be present in any given case it seems clear that this form of treatment must be useful, because in the milder cases it will result in rest of the affected part, and consequent rapid resolution; while in the severe cases it will guard against mechanical distribution of infectious material, and in all cases it reduces the tendency to meteorism and stops the pain.

There is, however, one class of patients in which I have found this treatment of the greatest value. I refer to the class in which the appendix is gangrenous or perforated and in which there is already a beginning general peritonitis. These patients give the

impression of being extremely ill. There is complete obstruction to the passage of gas or feces. There is nausea or vomiting and marked meteorism; the pulse is small and quick; usually there is high fever, but the temperature may be subnormal; respiration is rapid, and the abdominal muscles overlying the appendix are tense. The patient is in a condition in which I formerly operated at once, day or night as a last resort, only to find that it was too late in more than one-third of the number of cases, the mortality increasing with the time that had elapsed since the beginning of the attack. In this class of cases there is still a recovery of over 90 per cent. if the principles laid down above will be thoroughly applied.

If peristalsis is absolutely inhibited, as it can be, the infection will still become circumscribed and the pus can be evacuated with safety. Moreover, the condition I have just described is in itself the result of the administration of food and cathartics. Had these patients received neither food nor cathartics from the beginning of their attack, the condition would never have advanced to this dangerous point. This refers particularly to a class of cases which Richardson has so well described as being "too late for an early and too early for a late operation."

If the plan I have outlined above is carried out, the following changes are likely to occur: The nausea and vomiting will cease after one or two, or at most three, gastric irrigations. The meteorism and the pain will decrease greatly during the first twelve hours and will almost completely disappear in twenty-four hours. The pulse becomes slower and firmer and more regular, the breathing deeper and the patient's general appearance improves to an astonishing extent. If the temperature was high, it will go below 100°F. the first twenty-four hours, and in three days it will be practically normal. The abdominal muscles will become soft as soon as the stomach contents have been removed by gastric lavage.

Usually the improvement is so rapid that one is tempted to spoil everything by giving nourishment by mouth, because the patient's condition does not seem serious enough to warrant such severe measures.



That this form of treatment, which I have employed since 1892, at first only in selected cases, and later more and more generally, is really of great value is shown by clinical results. My mortality in cases of perforative or gangrenous appendicitis with beginning diffuse peritonitis is less than one-fourth as high as it was in the cases operated at once upon making the diagnosis, and even in advanced cases of diffuse peritonitis there has been a marked decrease in the mortality in my experience.

It might be said that these cases were not due to perforative or gangrenous appendicitis, but that they were simply severe catarrhal cases, which are known to result favorably under any form of treatment. To this I would respond, that I have later removed the appendices in many of these cases and have almost invariably demonstrated the correctness of the diagnosis.

In my statistics I utilize only the cases which I have operated in the Augustana Hospital, because of these I have full and accurate records, while of those operated in other hospitals and in private homes my records are not accurate, because there the patients and assistants are not so completely under my control.

From Jan. 1, 1898 to May 1, 1901, I have operated in this hospital upon 565 appendicitis cases, which I have divided into three groups: 1, those who entered the hospital suffering from diffuse peritonitis; 2, those who entered the hospital suffering from gangrenous or perforative appendicitis, and 3, those who entered the hospital suffering from recurrent appendicitis in the interval between attacks or at the beginning of a recurrent attack when the infectious material was still confined to the appendix. Of the first class I treated 18 cases, with 10 deaths, 55.5 per cent. mortality; of the second class I operated 179 cases, with 9 deaths, 5 per cent. mortality; of the third class I operated 368 cases, with one death,  $\frac{1}{3}$  per cent. mortality. Total, 565 cases, with 20 deaths, 3.5 per cent. mortality.

These statistics contain all patients who entered the hospital suffering from appendicitis; even those who died a few hours after admission from general peritonitis.

Of classes 2 and 3, all were operated, so there can be no doubt

concerning the diagnosis. Of class 1 all but 4 were operated, and these were in an absolutely hopeless condition when they entered the hospital. I will state also that during this time no patient suffering from appendicitis was refused admission into the hospital.

Judging from the authorities upon this subject, our mortality of 55.5 per cent. in diffuse peritonitis is as low as that recorded by any of the authors whose statistics contain a considerable number of these cases, while some authors with less than half this number report as low as 20 per cent. mortality. Krogius has compiled the statistics of 58 authors whose combined mortality is a little over 70 per cent.

As compared with my own experience in former years, when all of these cases were treated surgically at once, my experience in this series of cases of diffuse peritonitis following appendicitis is quite encouraging.

It is in the second class, however, in which the greatest benefit from the treatment is found. In this class, according to most modern authorities, Murphy, Mynter, Porter, Lennander, Bull, and many others, there is a mortality of at least 20 per cent. This in my cases has been reduced to 5 per cent.; and had the treatment been instituted at the beginning of the attack, I am certain that the mortality could easily have been reduced to one-half of this. In class 3 there should have been no death. Many of these cases had been treated through their acute attack by the method I have described, before being sent to the hospital. But as not all of the cases I treated outside of the hospital came later to operation, it is not fair to utilize these in demonstrating the value of the method.

Again, I have treated a large number of cases through the acute attack of appendicitis with this method which have never been operated and which I have not included in my statistics, because the correctness of the diagnosis could not be established by actually demonstrating the condition present in the appendix.

However, the fact that there was a mortality of less than one-third per cent. in so large a number of cases is significant. It shows the value of a method by which cases of acute appendicitis

in whom an operation is bound to give a high mortality at best, can be changed to chronic appendicitis in which the mortality following operation is almost nothing.

It would require too much space to tabulate all the cases treated by this method, but in order to give a clear idea of the character of these cases I have appended the histories of the cases suffering from perforative or gangrenous appendicitis which were treated through the acute attack during the past four months in the Augustana Hospital by means of the method I have described, and in which the correctness of the diagnosis was subsequently demonstrated by removing the diseased appendix during the operation.

In the same time I have treated many cases of acute perforative or gangrenous appendicitis in consultation with other physicians in private houses, but as these diagnoses have not been proved by the removal of the diseased organs they cannot be included in this list, although they corresponded with those who were operated both as regards the outcome and the conditions present during the attack, and there can be no reasonable doubt regarding the diagnosis.

It is, of course, not possible to come to any definite conclusions from a collection of statistics, because there are so many differences which cannot be balanced.

One hospital may be largely filled with patients from the lowest and least intelligent classes, which would indicate that the patients enter only after they are in an exceedingly serious condition. Another hospital may have a more intelligent class, and hence the cases are in a more favorable condition at the time of admission. Again, as an institution becomes known for the treatment of these cases, a larger number of relatively hopeless cases will be sent there, hence I believe it is practically impossible to draw fair conclusions from statistics, and one must depend largely upon personal experience.

Among these cases, No. 8896 is especially instructive, because it illustrates the danger of operating too early. The patient entered the hospital five days after the beginning of the attack. His condition was exceedingly grave, as indicated in the history.

With an immediate operation I should have expected his death within thirty-six hours.

The diagnosis was made of gangrenous appendicitis. He was placed on exclusive rectal feeding. Within twenty-four hours his pain had entirely disappeared, his general appearance improved greatly, the meteorism subsided, his temperature fell 3 degrees, his pulse came down forty beats per minute, his abdominal wall became soft, and twenty-four hours later I began to doubt my diagnosis. At the end of the fourth day his condition had improved so much that, upon his request, I concluded to operate, because he was normal in every respect with the exception of a slight induration in the region of the appendix and pain upon deep pressure. It seemed to me as though the process must have stopped just short of a perforation. Had he been left without an operation there could be no doubt but what he would recover temporarily from his attack. It seemed perfectly safe to operate.

Upon opening the abdomen I found a perforated gangrenous appendix surrounded by a small abscess completely walled off by the omentum. I removed the appendix and the surrounding pus with great care and drained the cavity, expecting the patient to recover, but a diffuse peritonitis developed, from which he died five days later. This case impresses the lesson, that it is not wise to operate until the patient has fully recovered from the acute attack. Of course, he should be cautioned as regards his diet in order to prevent a recurrence, but I am confident that the mortality in my practice will be still smaller in the future, especially because I shall wait longer after the acute attack before removing the appendix.

The danger of rupture of a circumscribed abscess into the general peritoneal cavity has been the cause of great anxiety. My experience has led me to conclude that this practically never happens unless food or cathartics are given by the mouth. In my entire experience it has happened but once, in a child 7 years old, which was brought to the hospital on the fifth day after the beginning of an attack of gangrenous appendicitis with beginning diffuse peritonitis. It had received food and cathartics

constantly since the beginning of the attack, and although its condition seemed hopeless either with or without an operation, it improved slightly from day to day under exclusive rectal feeding, but never became well enough to make drainage of rather an extensive infection of the entire area between the umbilicus and pubis and right anterior superior spine of the ilium safe, and still, had I anticipated the likelihood of a rupture into the remaining portion of the peritoneal cavity, I should certainly have made the attempt with the hope of bringing about a recovery.

On the fifth day the abscess suddenly ruptured. I anesthetized the boy within half an hour, made a free incision, washed out the peritoneal cavity, drained freely, but the child died in six hours.

In this case gastric lavage had not been employed because the child was very nervous and we feared the effects of the fright.

I have frequently seen cases in which food and cathartics were given in whom this accident occurred.

Aside from the benefit to the patient of increased safety there are other advantages to be derived from this plan of treatment, which are well worth considering. Being able to operate during the quiescent stage, drainage is not indicated, and consequently there is no likelihood of the occurrence of post-operative ventral hernia. With the reduction of the area of infection, the amount of peritoneal adhesions must necessarily be reduced. As a matter of experience, I can say that fecal fistulae almost never occur in cases treated by this method.

Of course, all these advantages, as well as the prevention of diffuse peritonitis, can be accomplished if the appendix is removed during the very beginning of the attack, before the infectious material has passed beyond the walls of the appendix, but unfortunately it is but seldom that a patient enters the hands of a surgeon at so early a stage.

The following consecutive histories illustrate the class of cases under this form of treatment. The number at the beginning of each history is for the purpose of identification in the Augustana Hospital records.

No. 8573.—Master Harold B., school boy, 7 years of age,

operated on Jan. 9, 1901, gave the following history: He had whooping cough at 3 weeks of age, otherwise he had been well. Fifteen months ago patient was taken with headache, vomiting, pyrexia 100°F., and pain in abdomen only on pressure in right inguinal region. Then perfectly well until six weeks ago, when patient was again taken with headache, vomiting, pyrexia and tenderness in right inguinal region. The abdomen was severely distended with gas. The attack was much more severe than the first one. Patient placed upon exclusive rectal alimentation for two weeks. Headache and vomiting left him in a day, but tenderness has persisted, and he has usually had a slight evening rise of temperature of about 100°F.

Present Condition: Well developed, fairly well nourished, slightly anemic, temperature 99.4, pulse 90, regular and strong. Appetite good, bowels constipated, heart and lungs normal. Abdomen slightly distended, quite tympanitic, except lower portion of left inguinal region. At times tenderness at right inguinal region.

Treatment: McBurney's incision 6 cm. long. Appendix 7 inches long, curved on itself back behind to cecum, is adherent to posterior surface of cecum. Appendix is ulcerated to an extent approaching perforation, contains several concretions. The lymphatics in the mesentery are enlarged to size of army bean. Appendix crushed with strong forceps at cecal end. Stump inverted with silk purse-string suture. No drainage. Wound closed. Dry dressings. Straps. Patient recovered normally, leaving hospital Feb. 5, 1901.

No. 8582.—Master Jerome R., 8 years of age, operated on Jan. 28, 1901, gave the following history: Patient experienced the ordinary diseases of childhood. At the age of 1½ years he had peritonitis and was very ill for three weeks. On Jan. 1, 1901, he felt indisposed, having eaten an unusual amount of nuts the night before, and on the following morning he suffered from severe pain in the abdomen, accompanied with vomiting and diarrhea. The pain was paroxysmal in character, became located in the right inguinal region on the second day. The bowels became distended with gas, and after the first day there

was complete obstruction to the passage of gas and feces. Vomiting persisted for five days, until patient absolutely refused to take food, when the vomiting ceased. Entered hospital Jan. 9, extremely ill with diffuse peritonitis. The abdomen was greatly distended with gas and extremely tender. Temperature 102°F., pulse 120. He was placed on exclusive rectal alimentation, whereupon he improved rapidly. On January 17 his pulse and temperature were normal, his abdomen but very slightly distended, his complexion and facial expression were good. There was slight tenderness in the hypogastric and right inguinal region. His heart, lungs and kidneys were normal. He was now given beef-tea by mouth, but the rectal alimentation was continued. There was an area of induration in the vicinity of McBurney's point which persisted. Exclusive rectal feeding was continued for three weeks.

On Jan. 28, 1901, four weeks after the beginning of the attack, an abdominal section was made through the right rectus abdominis muscle 6 cm. long, opposite McBurney's point. The peritoneum was found congested, the intestines empty. In front of the right iliacus muscle was found a mass, consisting of the cecum, the omentum and the cecal end of the ileum, surrounding a circumscribed abscess containing the perforated appendix and a number of fecal concretions. The appendix was removed, the stump inverted, the wound drained with gauze and glass drains. The appendix contained a perforation 3 cm. from its end. The peritoneal cavity contained a considerable quantity of sero-sanguinous fluid. The patient left the hospital well April 2, 1901.

No. 8589.—Mr. Anton N., a fireman, 23 years of age, entered the hospital Jan. 10, 1901. He gave the following history: Aside from having experienced the diseases of childhood, he had always been well. In May, 1900, he experienced a mild attack of acute appendicitis continuing for five days. Felt well after this until 18 days ago when patient again experienced severe pain, first in the epigastric region, which became localized in the vicinity of the appendix. He suffered from diarrhea and vomiting for one day.

Under treatment with exclusive rectal diet the pain, which was at first very severe, decreased rapidly and disappeared in five days, leaving only soreness for ten days longer. The rectal feeding was continued for two weeks.

Present Condition: The patient is well nourished, the tongue is clean, appetite good, bowels constipated, heart, lungs and kidneys normal, temperature 98.6°, pulse 80, regular and strong. There is some tenderness and resistance a little below McBurney's point.

Operation: McBurney's incision 5 cm. long. Appendix coiled upon itself and adherent throughout between cecum and iliacus muscle, perforated 2 cm. from end into cecum. The wound in the latter had healed. The appendix was exceedingly brittle, edematous and congested and its lumen was almost completely obliterated at the cecal end. The appendix was removed and its stump inverted into the cecum and the space closed by purse-string suture. The abdominal wound was closed. The patient recovered normally, leaving the hospital on Feb. 12, 1901.

No. 8630.—Mrs. David B., 46 years of age, was operated on Jan. 23, 1901. The patient is so deaf that it was difficult to obtain a history. She has been married for 22 years, has had seven pregnancies, the last one 10 years ago. Has had two miscarriages. For several months she has suffered from incomplete intestinal obstruction, accompanied with nausea and eructation of gas and indefinite pain in the abdomen. A diagnosis of chronic appendicitis had been made, but during the past two weeks her condition has been more serious, her deafness, however, makes it impossible to obtain a definite history except that she is and has been very ill. Her facial expression is bad, her abdominal walls tense. She complains of pressure over the entire abdomen, but especially over the region of McBurney's point and in the region of the sigmoid flexure of the colon. She had traveled a distance of 400 miles by rail and was extremely exhausted. She was placed in bed and given exclusive rectal alimentation for four days. Her heart, lungs and kidneys were normal and her general condition improved under this treatment, under which she had been for a week before entering the hos-



pital. An exploratory incision 5 inches in length was made in the median line and the appendix was found surrounded by omentum. The former was perforated a short distance from its distal extremity and at this point was found a small abscess containing a dram of pus and an enterolith. The appendix was removed, together with the portion of the omentum containing the abscess. The patient developed a pneumonia four days after the operation from which she recovered as well as from her operation. She left the hospital March 9, 1901.

No. 8699.—Miss Freda W., 20 years of age, operated on Feb. 3, 1901, gave the following history: Patient has experienced all of the children's diseases. At the age of 9 she injured her knee-joint by falling upon broken glass. The wound became infected and patient was extremely ill for several months, recovering with an ankylosed joint. Menstruated at 13, regular and painless for two years, since then has suffered considerable pain, more especially in the right side, lasting from two hours to two days at each period. For the past four years, patient has been anemic, nervous and not very strong. Seven months ago she began to have occasional pains in the region of McBurney's point at intervals of about two weeks, most severe, however, during menstrual period. Her appetite was bad, her digestion impaired, her nervousness increased. About Nov. 1, 1900, the pain became persistent and was accompanied with nausea and eructation of gas.

On December 16 patient suffered from an exceedingly violent, acute attack of appendicitis, characterized by extreme pain, nausea, vomiting and a distinct chill, pulse increased to 130 per minute, temperature 100°F. No food of any kind was given after the beginning of the attack. She was kept on exclusive rectal alimentation for ten days. One hypodermic injection of one-fourth grain morphia was given the first day. The pain subsided within twenty-four hours, but the patient's general condition was bad on account of the severeness of the attack. There was tenderness in the vicinity of McBurney's point for two weeks, which continued upon pressure until the time of the operation. Ten days after the beginning of the attack she was

given beef-tea by mouth for four days, then liquid diet for two weeks, then light diet until the time of the operation.

Present Condition: Fairly well nourished, but anemic, appetite fair, bowels regular. Eructations of gas after eating. Heart, lungs and kidneys normal. Slight pain in the region of McBurney's point upon deep pressure. Ankylosis of right knee at angle of 165 degrees.

Treatment: McBurney's incision 6 cm. long. Appendix found severely congested, its lumen reduced to one-fourth its normal size at the cecal end. The distal end somewhat club-shaped, contained four fecal concretions. The mucous membrane of the appendix was ulcerated. The appendix was universally adherent, the adhesions being soft and due to the recent attack. Appendix removed, stump buried with purse-string suture. Abdominal wound closed. The patient recovered normally, leaving the hospital three weeks after the date of operation.

No. 8757.—Master Herman M., 5 years of age, operated on March 1, 1901, gave the following history: At 3 years of age he had measles and scarlet fever. In August, 1900, he was sick for several weeks with pyrexia and pain in the region of the umbilicus. Fairly well after this until two weeks ago patient had a slight attack of diphtheria; antitoxin was immediately administered and child became well in a few days. One day before admission, patient was dull, sleepy and feverish. That night he vomited some. Magnesia was given, this was followed by colicky pain in abdomen. Pain in region of umbilicus persisted.

Feb. 19, 1901. Since admission temperature has ranged from 100° to 104°F. Patient has had the appearance of being extremely ill.

Present Condition: Considerably emaciated. Sordes of teeth. Teeth badly decayed. Tongue slightly coated. Quite hungry. Temperature 102, pulse 130, regular and strong. Heart and lungs and kidneys normal. Complains of pain in region of umbilicus. Some tenderness there and in right inguinal region. Spleen not enlarged.

Treatment: Exclusive rectal alimentation for three weeks. McBurney's incision 5 cm. long. Appendix found bent by two

bands of adhesions. Appendix congested and filled with dark, bloody fluid. Appendix removed in usual manner and stump buried with purse-string suture. Wound closed. Patient recovered normally, leaving the hospital March 29, 1901.

No. 8767.—Mr. Andrew B., a laborer, 36 years of age, admitted Feb. 19, 1901, gave the following history: At 13 he suffered from an attack of diphtheria, otherwise he has been well, with the exception of having occasional slight stomach disturbances. In December, 1900, he had pain in lumbar region, which patient thought was rheumatism. He stopped work for a few days. On Jan. 23, 1901, he began to feel ill, an hour later had a chill followed by vomiting and abdominal distention. Diffuse abdominal pains. January 28 pain became localized in right inguinal region and on the 29th he had marked pyrexia. Confined to bed about two weeks, since then quite well, except some soreness in right inguinal region.

Present Condition: Fairly well nourished, 30 pounds under weight, tongue slightly coated, appetite good, but if he takes nourishment there is an increase in the pain and gaseous distention and patient experiences nausea. Patient has the appearance of being very ill, although he has been out of bed and able to walk about a little. Heart and lungs normal. Abdominal wall thick. Considerable resistance and marked tenderness in right inguinal region. Considerable gaseous distention.

Treatment: Patient placed on rectal alimentation for three days, mainly for the purpose of overcoming the gaseous distention, previous to performing the operation. Operation February 22. McBurney's incision, which was lengthened by extending incision along outer border of rectus abdominis. Appendix found adherent in a mass, and perforated 3 cm. from cecum. Appendix loosened from adhesions and removed. Stump buried with purse-string suture. Primary incision closed. Counter-opening made opposite anterior superior spine and glass tube and gauze drainage inserted. Wet dressings. Patient recovered normally and left the hospital April 8, 1901.

No. 8836.—Mr. Chas. A., an engineer, 33 years of age, admitted March 5, 1901, gave the following history: He had experi-

enced the diseases of childhood, otherwise he had been quite well. Twelve days ago was taken with a diffuse pain in abdomen, not very severe, able to be about, no vomiting or constipation, but nausea. Ten days ago was taken with severe pain, colicky, all over abdomen, severe nausea, but no vomiting. About one day later, pain localized in right inguinal region. Improved slowly under treatment with exclusive rectal alimentation and four days ago was able to be up. Two days ago pain recurred after eating a little, whereupon nourishment by mouth was again prohibited for five days.

Present Condition: Fairly well nourished, tongue thickly coated. Temperature 98.3, pulse regular and strong. Heart and lungs normal. Considerable resistance and tenderness in right inguinal region.

Operation: March 8, 1901; McBurney's incision. The appendix was found adherent to the lower end of the cecum and the anterior surface of the iliacus muscle and surrounded by the omentum. It was bent upon itself in the form of an interrogation point, club shaped at its distal end and perforated near its end and surrounded by a slight amount of pus. Appendix removed, wound drained. Patient recovered normally, leaving the hospital April 12, 1901.

No. 8872.—Maurice R., 13 years of age, school-boy, entered hospital March 13, 1901, giving the following history: The family history is good with the exception that father has suffered from an attack of appendicitis, one sister was operated for recurrent, non-perforative appendicitis and one brother for acute perforative appendicitis complicated with diffuse peritonitis. The patient has always been well with the exception of having an attack of typhoid fever two years ago, and one year ago had a severe pain in right inguinal region with slight pyrexia. Pain severe for about two days, since then has not felt very well, having a constant grumbling pain in right side. About twenty-four hours ago was seized with a sudden pain in right side. Pain very severe up to present time. Being under the direct care of his sister, who had experienced severe attacks of recurrent appendicitis, feeding by mouth was at once prohibited.

Present Condition: Fairly well nourished, general condition good. Considerable rigidity and tenderness in right inguinal region.

Treatment: McBurney's incision. Proximal end of appendix constricted, distal end enlarged, curved on itself in the shape of a question mark. Surface covered with lymph. Removed; stump buried; wound closed. The end of the appendix contained a hard fecal concretion and pus. The mucous membrane was ulcerated and the end of the appendix appeared as though it were about to perforate. The appendix was surrounded by the omentum, which had already become attached by a fine layer of plastic lymph, completely separating the infected organ from the remaining portions of the peritoneal cavity. The patient recovered normally and was discharged from the hospital April 2, 1901.

This case is interesting especially because it shows how early after the beginning of an attack the general peritoneal cavity will be protected against infection.

No. 8879.—Miss Hannah J., a housemaid, 26 years of age, came under my care March 14, 1901, giving the following history: Two brothers and father had stomach trouble, otherwise family history was good. She had had the ordinary children's diseases, otherwise well. Began to menstruate at 14, regular and painless. For several years patient had complained of bilious attacks, coming one to four times a year. During these attacks she was taken with fever, vomiting and some pain in epigastrium, lasting from one to three days, leaving a soreness in epigastrium. About one year ago, patient had a more severe attack than usual. Patient was taken with vomiting, pain, pyrexia and pain in epigastrium, which radiated to right inguinal region, leaving a soreness there. The attack lasted three days. October, 1900, had a similar attack, but not so severe. Eight weeks ago, patient was taken with pain in stomach, about five hours later began to vomit, the pain becoming more severe. A few hours later radiated to right inguinal region. No pyrexia. This lasted about three days, then patient got up and was around for four days when she began to feel badly again but was not compelled to go to bed for three days after this, when she was confined to

bed for two weeks with pyrexia. Was given no food by mouth for ten days. Pain and soreness in right inguinal region. She said she could feel a mass in right inguinal region the size of a goose egg.

Present Condition: Well nourished, slight coat on tongue, appetite good, bowels regular, temperature 99, pulse 62, regular and strong. Heart and lungs normal, abdomen not distended, no abdominal dullness on palpation, slight tenderness and resistance in right inguinal region.

Operation: March 15; incision through right rectus abdominis muscle 19 cm. long. Appendix perforated and universally adherent. Appendix removed and wound closed. Recovery normal, patient discharged from hospital April 9.

No. 8896.—Mr. Oscar L., a factory worker, 21 years of age, came under my care March 18, and gave the following history: He had had measles as a child, and at 12 had some trouble with left hip which confined patient to bed for thirteen weeks. March 21, 1901, nine days ago, had slight diffuse pain in abdomen for two hours, after that felt perfectly well until five days ago when supper did not taste very well and at 10 p.m. that night began to have slight pain in abdomen, then severe vomiting, then pain became very severe, more pronounced in right inguinal region. Vomited all first night and following morning after taking coffee. Since then has had nothing by mouth. Vomited only once, but is still nauseated. Temperature 103°F., pulse 110 per minute.

Present Condition: Well nourished, but has appearance of being extremely sick. Tongue thickly coated, face flushed, quite thirsty. Heart and lungs normal. Abdomen considerably distended, considerable tenderness, more pronounced in left inguinal region. No dullness, quite tympanitic.

Exclusive rectal alimentation for four days. After the second day the temperature and pulse were nearly normal and at the end of the fourth day his general condition was so much improved that it seemed likely that he was suffering from a catarrhal instead of a perforative appendicitis, hence I consented to operate instead of continuing the treatment.

Operation: March 22; McBurney's incision. Peritoneum and

intestines inflamed. General peritoneal cavity packed away with a large pad. Cecum and appendix loosened and a large abscess opened into. This sponged out, and perforated appendix containing a large fecal stone removed subperitoneally, clamped, ligated, removed, not covered in by purse-string suture, as cecum could not be brought up. Glass and iodoform gauze drainage. Wet dressings.

The patient died on the fifth day after the operation from diffuse peritonitis.

There is no doubt in my mind but what this patient would have recovered fully had his operation been postponed for a few weeks. When he entered the hospital his condition was so serious that it seemed certain that he would die were he operated upon at once. His general appearance was exceedingly bad. His abdomen was greatly distended with gas and exceedingly tense. His condition improved so rapidly after applying gastric lavage and prohibiting all oral feeding, that it seemed likely that our first diagnosis of perforative appendicitis must be wrong. Hence too early operation with disastrous result.

No. 8963.—Mr. Alex S., a boy 16 years old, admitted April 1, 1901, gave the following history: He had had children's diseases, otherwise he had been well until four years ago when he had typhoid fever. Shortly after convalescence he took a severe cold, followed by pneumonia, then by empyema on right side. He has had two operations for empyema. Has been perfectly well except slight discharge from sinus on right side of chest, until two weeks ago. At this time patient's stomach troubled him a little. Six days ago in the evening after eating heartily he was taken with pain and vomiting (pain in epigastrium). Pain continued during night and then felt fairly well for next two days. Two days ago ate a hearty dinner, four hours later was taken with severe pain over lower portion of abdomen, then followed a few hours later by vomiting, which was extremely violent. The abdomen became greatly distended with gas and patient was in a condition of severe shock. The pain at this time was diffuse and it was not possible to determine the cause of the intestinal obstruction positively. Gastric lavage and exclusive

rectal alimentation were employed. These symptoms persisted about thirty-six hours, for past twelve hours has had no pain.

Present Condition: Fairly well nourished; hungry, bowels constipated, tongue coated. Pulse 104, regular and strong, temperature 99. Nothing abnormal on percussion of abdomen. Slight tenderness in median line about two inches below umbilicus.

Treatment: Exclusive rectal alimentation was employed for two weeks. Operation April 17, 1901. Incision through right rectus abdominis muscle 8 cm. long. Peritoneum found studded with tubercles and intestines adherent. The appendix and cecum were in a mass of tubercular tissue to such an extent that it was not possible to remove the appendix without leaving large raw surfaces. Consequently none of the tissues were disturbed. The free peritoneal fluid was sponged away and the abdominal cavity closed. In these cases our results have been very satisfactory whenever we have simply closed the abdominal cavity, while they have been the reverse whenever we have removed portions in cases in which it was not possible to cover the raw surfaces thus produced. The patient made a normal recovery, leaving the hospital May 17.

No. 8984.—Mr. Andrew G., 36 years old, laborer, came under my care April 7, 1901, giving the following history: Family history good. Was healthy during childhood; had diphtheria at age of 18, inflammatory rheumatism at 28 for a period of three months; had a recurrence at 31 for one month. Eighteen months ago had a varicocele operation. Nine days ago he noticed a diffuse abdominal pain, which came on slowly and continued for six days, being less severe at night, especially if the patient lay on his right side. It became localized in the region of McBurney's point. Two days ago, after taking a cathartic, the pain increased greatly and nausea and vomiting occurred and the patient became seriously ill, indicating the diagnosis of perforative appendicitis. Feeding by mouth was at once prohibited and the patient began to improve at once. The nausea and vomiting disappeared, the abdominal walls became less tense, gaseous distention decreased and his general appearance improved.



Present Condition: Well nourished; patient feels hungry; tongue is coated; flatus is expelled; temperature and pulse are normal; heart and lungs and kidneys are normal. The abdomen is asymmetrical. In the right inguinal region there is a mass the size of a hen's egg which is firm and tender upon pressure. Result of varicocele operation perfect. The improvement in the condition is attributed to the fact that no food has been given for two days. The patient was placed on exclusive rectal alimentation for eleven days. In the meantime the induration has decreased, so that now it is only the size of a walnut and not tender. In every way the patient's condition is good.

Operation: April 18, incision five inches in length through outer border of right rectus abdominis muscle. Cecum and ileum adherent to omentum. Appendix adherent behind cecum, perforated in a small abscess cavity, containing a dram of pus. Appendix very brittle, breaking several times during manipulations. Abscess cavity sponged out and drained. Wound closed. Patient recovered normally. Left hospital May 19.

No. 9000.—Mr. L. C. H., teamster, 19 years of age, came to the hospital April 9, 1901. He gave the following history: He had always been well. On April 7 he was taken with frontal headache, slept fairly well that night, but awoke feeling worse, and began to have a diffuse abdominal pain. After taking some medicine began to vomit and could not get bowels to move. Vomiting persisted, until all mouth feeding was stopped the following day. Pain persisted and became localized in right inguinal region on second day. Bowels moved with simple enema on the 10th.

Present Condition: Patient appears and feels very ill, face anxious but flushed. Well nourished, tongue coated, hungry, and especially thirsty. Heart and lungs normal. Abdominal muscles held rather tense, a little more so in right lower quadrant. Tenderness at McBurney's point, abdomen distended with gas. Temperature 101°F., pulse 90. Patient was placed on exclusive rectal alimentation for six days. His condition improved from day to day, all the serious symptoms disappearing by the end of the third day.

Operation: May 15, incision through right rectus muscle 10 cm. long. Appendix severely congested, shortly bent and constricted at its cecal end, tied down in a bed of adhesions its entire length to posterior surface of cecum. Mesenteric glands enlarged, the largest the size of a bean. Appendix removed by separating base first and then dissecting towards apex of appendix. Apex of appendix extended up behind the gall-bladder. Wound closed. Appendix contained ulcerated areas of the mucous membrane, a fibrous constriction near the cecal end, and its lumen contained pus and fecal material. Patient recovered normally, leaving hospital on May 13, 1901.

No. 9002.—Mr. Simon Q., an iron-worker, 40 years of age, came under my care April 10, 1901. He gave the following history: One brother died of carcinoma of the stomach and mother of asthma. He has twelve brothers and sisters and father, living and well. From four to six he was troubled with some infection of neck. Between 14 and 19 he was troubled with dyspepsia. Four weeks ago was taken with severe pain in region of umbilicus, vomiting and chill. Ingestion of food or water aggravated vomiting, pain became more diffuse, but patient continued to work until two weeks ago, when he became too weak to work. About this time pain became localized in right inguinal region, pain and vomiting persisted.

Present Condition: Somewhat emaciated, tongue thickly coated, dentine on every tooth exposed. Appetite poor, bowels constipated, heart and lungs normal. Abdomen considerably distended, but soft. No abdominal tenderness, temperature 99°F., pulse 62, regular and strong. No history of jaundice or vomiting before this attack. Has been constipated for years. Patient placed on exclusive alimentation for five days. Gastric lavage employed. Nausea and vomiting subsided and gaseous distention disappeared. April 14, patient's general appearance has improved greatly. Abdomen scaphoid. Tympany has subsided almost completely. Some tenderness under left costal arch, where there is a slight swelling, which moves downward on inspiration. Has had bleeding from hemorrhoids for several

years. A few hemorrhoids, otherwise rectal examination negative.

Operation: April 15, incision through right rectus muscle. Appendix severely congested, as the result of acute inflammation, club-shaped and adherent; constricted at cecal end, contains gas, fecal material and mucus. Its mucous lining is obliterated. An apparent old tear in serous covering of cecum sutured. Appendix removed in usual manner. A carcinoma, size of goose egg, involving transverse colon, just to right of splenic flexure. The lymphatic glands in the mesentery are secondarily involved. Adherent small intestines loosened and tear sutured by silk Lembert sutures. An anastomosis with needle and thread made between sigmoid flexure and transverse colon 7 cm. long. Wound closed. Patient recovered normally. Left hospital May 15.

These histories comprise all the cases of acute perforative appendicitis I have operated on in the Augustana Hospital during the past four months. There is but one death among them, and that must be credited to a lack of judgment. The histories, although necessarily much abbreviated, give a clear idea of the progress of the disease in such cases whenever this form of treatment is employed. I am positive that the mortality would have been at least four times as great had all these patients been operated at once, upon admission. There are three cases which do not properly belong in this group, because perforation had not actually taken place, but I am confident that this was only prevented by the treatment. Moreover, each one of these cases had quite advanced peritonitis at the time of admission, which would undoubtedly have progressed rapidly had not peristalsis been inhibited. In each of these cases the attack was exceedingly violent until this form of treatment was instituted, but subsided very promptly after commencement of this treatment.

#### CONCLUSIONS

As a result of my clinical observations I am prepared to formulate the following conclusions:

1. Peristaltic motion of the small intestines is the chief means of carrying the infection from the perforated or gangrenous appendix to the other portions of the peritoneum, changing a circumscribed into a general peritonitis.

2. This can be prevented by prohibiting the use of every kind of food and cathartics by mouth, and by employing gastric lavage in every case in which there are remnants of food in the stomach or in the intestines above the ileocecal valve, as indicated by the presence of nausea or vomiting or meteorism.

3. The patient can be supported by the use of concentrated predigested food administered as enemata not oftener than once in four hours and not in larger quantities than four ounces at a time.

4. This form of treatment, when instituted early, will change the most violent and dangerous form of acute perforative or gangrenous appendicitis into a comparatively mild and harmless form.

5. Cases of perforative or gangrenous appendicitis, with beginning general peritonitis, can usually be carried through the acute attack safely with this method.

6. In all cases of this class gastric lavage should be practiced in order to prevent the absorption of decomposing material from the alimentary canal.

7. In cases of doubtful diagnosis this form of treatment should always be employed.

8. This treatment will prevent a large proportion of the most troublesome complications and sequelae of appendicitis, such as ventral hernia, fecal fistulae, extensive adhesions, etc.

9. The patient should be permitted to recover fully from his acute attack before an operation is performed, except in cases encountered within the first thirty-six hours after the beginning of an attack or in case of the formation of a superficial circumscribed abscess.

10. It often requires but a small amount of any kind of food to change a harmless circumscribed into a dangerous diffuse peritonitis.

11. The treatment does not protect the patient against a subsequent attack.

12. It does not contraindicate the removal of a diseased appendix before the septic material has extended beyond this organ.

13. It is indicated in all intra-abdominal conditions in which it is desirable to prevent the distribution of septic material by means of peristaltic motion.

14. The laity should be taught to stop feeding and giving cathartics to patients suffering from intra-abdominal diseases.

*710 Sedgwick Street, Chicago.*

THE END

# MEDICAL CLASSICS

*Compiled by*

EMERSON CROSBY KELLY, M.D., F.A.C.S.

OF THE DEPARTMENT OF SURGERY, ALBANY MEDICAL COLLEGE

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## Giovanni Battista Morgagni

- 1682 Born February 25th in Forli, a small city near Bologna, Italy. His father died while Morgagni was still a child and his mother shouldered the responsibility of supporting and educating him.
- 1696 Age 14. Because of love of literature and extensive knowledge, he was elected to the Academy at Forli.
- 1697 Age 15. Sent to the University of Bologna which was about forty miles from his home and entered as a student of medicine and philosophy. Among his teachers were Albertini, de Sandris and Valsalva. He devoted much time to the study of anatomy and served as proceptor and demonstrator for Valsalva. Performed anatomical dissections for Valsalva's work *Anatomy and diseases of the ear*, 1714.
- 1701 Age 19. Received M.D. degree at Bologna and became an assistant to Valsalva.
- 1705 Age 23. With a number of associates Morgagni undertook the organization of a new medical school at Bologna of which he was made president. The school did not prosper and was soon closed. Morgagni then spent a few years in study at the University of Padua and at Venice but his health failed because of extensive study. On returning to Forli, he established a medical practice.
- 1706 Age 24. Published first part of his *Adversaria anatomica*.
- 1711 Age 29. Elected to the chair of Theoretical Medicine at Padua, taking the place of Vallisneri who, in turn, had succeeded Guglielmini as Professor of Medicine.
- 1715 Age 33. Elevated by the Senate at Venice to the profes-

sorship of anatomy at Padua, a successor to an illustrious line of scholars including Vesalius, Fallopius, Fabricius, Casserius and Spigelius. Taught at Padua for nearly sixty years.

1761 Age 79. Published *De sedibus et causis morborum per anatomen indagatis* in which he put the results of his life work and the detailed study of more than six hundred dissections performed by himself into seventy letters making up five books.

1771 Age 89. Died on December 6th at Padua.

### EPONYMS

APPENDIX—(a) a small diverticulum extending upward between the ventricular fold medially and the thyreo-arytenoid muscle and thyroid cartilage laterally.

(b) the cyst-like remnant of the müllerian duct attached to an oviduct or testicle.

CARTILAGE—the arytenoids.

CARUNCLE—of middle lobe of prostate.

CATARACT—a fluid cataract with a hard nucleus.

COLUMN—mucous membrane of lower rectum and anus gathered into longitudinal folds or columns with shallow pits between.

CONCHA—nasalis superior.

CRYPTS—between columns of mucous membrane (of Morgagni) in lower rectum.

CYST—the cyst-like remnant of the müllerian duct attached to an oviduct or testicle.

FORAMEN—(a) between the sternal and costal attachments of the diaphragm, the site of hernia of Morgagni.

(b) the interval between the basilar process of the occipital bone and the upper border of the superior constrictor muscles of the pharynx.

FOSSA—the fossa navicularis of the urethra.

FRENUM—a fold formed by the joined extremities of the ilioocolic valve, extending partly around the interior of the colon.

GLANDS—racemose glands in the spongy portion of the urethra, same as Littré's glands.

- GLOBULES—minute hyaline spheres sometimes found between the eye-lens and its capsule, chiefly in cases of cataract.
- HERNIA—through the foramen of Morgagni. Parasternal hernia. Hernia diaphragmatica vera sternalis.
- HUMOR—the fluid between the eye-lens and its capsule.
- HYDATID—the cyst-like remnant of the müllerian duct attached to an oviduct or testicle.
- LACUNA—openings of numerous tubular depressions of the mucous membrane on the dorsal wall of the cavernous portion of the urethra.
- LIQUOR—same as humor.
- NODULE—same as the bodies of Arantius, nodulus valvulae semilunaris.
- PROLAPSE—chronic inflammatory hyperplasia of the mucosa and submucosa of the sacculus laryngis.
- SINUS—the space between the superior arched border of the superior constrictor of the pharynx and the basilar process. It is devoid of muscular fibers, semilunar in shape and is strengthened by the pharyngeal aponeurosis.
- TUBERCLE—the olfactory bulb.
- VALVES—anal valves; semilunar valves between lower ends of longitudinal folds of rectal mucous membrane.
- VENTRICLE—the laryngeal ventricle—on either side between the planes of the ventricular and vocal folds. It is a little antero-posterior pocket of the mucosa reaching from the level of the arytenoid nearly to the angle of the thyroid cartilage, and undermining the ventricular fold; it opens into the cavity of the larynx by a narrow mouth limited above and below by the ventricular and vocal folds. From its anterior part a small diverticulum, the ventricular appendix extends upward between the ventricular fold medially and the thyreo-arytenoid muscle and thyroid cartilage laterally.

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## INTRODUCTION

Giovanni Battista Morgagni led an active life of study, research and teaching, but we are fortunate that he lived to a very old age because he published his greatest book in his eightieth year. He had started the publication of his *Adversaria anatomica* at the age of twenty-four and nine years later was elevated to the professorship of anatomy at Padua where he succeeded such a famous series of doctors as Vesalius, Fallopius, Fabricius and Casserius. Morgagni soon became famous as a teacher and as a student of disease. He studied about six hundred and forty postmortem examinations and in each case he attempted to correlate the clinical history with the postmortem findings.

In 1761 at the age of seventy-nine Morgagni wrote his observations, the sum total of his life study, in a series of seventy letters which make up five books. He gave his work the title, *De sedibus et causis morborum per anatomen indagatis*, which indicates that the author was finding the definite seat or locality of the disease process. Before Morgagni doctors had spoken of an imbalance or improper mixture of the humors. After Morgagni they realized that a disease arises from definite changes in some organ of the body and that these changes are constant for any particular disease.

Thus Morgagni is spoken of as the father of the "anatomical concept." His correlation of symptoms and signs of a disease with the subsequent postmortem findings was the beginning of the science of pathology. He was the first to describe many new things in medicine and the list of eponyms associated with his name covers nearly every region of the body.

Garrison in his *History of medicine* writes that Morgagni "gave the description of cerebral gummata and diseases of the cardiac valves; early accounts of syphilitic aneurysm, acute yellow atrophy of the liver, and tuberculosis of the kidney, and the first recorded case of heart-block; identified the clinical features of pneumonia with solidification of the lungs, emphasized the extreme importance of visceral syphilis, and was the first to show that intracranial suppuration is really a sequel of discharge from the ear, a phenomenon which even Valsalva had conceived the other way around. He proved, in many autopsies, the Valsalva dictum that the cerebral lesion in apoplexy is on the opposite side from the

resulting paralysis. The *De Sedibus* abolished humoral concepts in pathology for a long period of time."

The selections from *De sedibus et causis morborum* which are herein reproduced are taken from the translation by Benjamin Alexander, published in London in 1769. Included in these letters are details of some of Morgagni's important discoveries. His descriptions are landmarks in the study of these particular subjects.

Letter 1, *Of pain in the head*, covers many pathologic conditions of both the brain and the meninges.

Letter 9, *Which treats of the epilepsy*, contains in Section seven an account of heart-block.

Letter 26, *Treats of sudden death, from a disorder of the sanguiferous vessels, especially those that lie in the thorax*, contains several descriptions of aneurisms.

Letter 37, *Treats of the jaundice, and of bilious calculi*, contains many descriptions of the different pathologic conditions of the gall-bladder and many accounts of gall-stones, not only in the gall-bladder, cystic duct and common bile duct, but even in the intestine.

Throughout his writings Morgagni gives many references to earlier scholars and to the literature of his day. We are able to see what a vast knowledge he had and what a thorough worker he was. The references have lost most of their value for the modern reader and are not included in this work.

Morgagni's *De sedibus et causis morborum* marked the turning point from an ancient conception of disease to the modern one. Here we see the first combination of clinical history and underlying pathology of most of the diseases that we recognize today. Morgagni's writings are classics and, therefore, are fittingly included in this series of publications.



# The Seats and Causes of Diseases

Investigated by Anatomy

In Five Books, Containing a Great Variety of Dissections, with  
Remarks. To Which Are Added Very Accurate and Copious  
Indexes of the Principal Things and Names  
Therein Contained

TRANSLATED FROM THE LATIN OF

JOHN BAPTIST MORGAGNI

*Chief Professor of Anatomy, and President of the University of Padua*

BY BENJAMIN ALEXANDER, M.D.

IN THREE VOLUMES

London, Printed for A. Millar; and T. Cadell, his Successor, in the Strand; and Johnson  
and Payne, in Pater-noster Row, 1779

BOOK THE FIRST

WHICH TREATS OF DISORDERS OF THE HEAD

LETTER THE FIRST

OF PAIN IN THE HEAD

**I**N ORDER to perform what I promised you, I will begin with the pain of the head; but do not expect, that I shall include in this letter, all the causes of that pain, which have occurred to Valsalva, or myself in dissections. Most of them will be recounted hereafter, on other occasions. For this pain, not only attends disorders of the head itself, but is frequently joined, to those of other parts of the body. And indeed, of itself alone, it is perhaps never mortal: for which

reason, I have but few histories thereof to introduce here, and these only treat of it as preceding other disorders, or as a threatening symptom which attended them. I will first give you an instance of each kind from Valsalva.

2. A boy of thirteen years of age, of a ready wit, whose brother and sister had died of a consumption, having himself laboured under an inflammation of the left lobe of the lungs the year before, was seized with a pain in his head over his eyes: his eyes were also painful, and troubled with a viscid defluxion. The day following he became delirious; his eyes were fixed on those about him; and he threw up a little tough phlegm. Then on a sudden, he was seized with convulsions; after which he fell into a kind of lethargy: yet was frequently roused by convulsions, attended with difficult respiration. At length he died. When the abdomen was opened, the viscera were all found to be in a sound state: but the stomach, contained a kind of aeruginous humour, the bladder was turgid with urine, and the gall-bladder with bile. In the chest, the right lobe of the lungs did not adhere to the pleura; but in the upper part toward the clavicle contained a tubercle almost as big as a walnut, in which were little cavities full of matter, that in colour and consistence resembled the medullary substance of the brain. And this perhaps would have given rise to a disorder, had the youth lived longer, similar to those which took off his brother and sister. But the left lobe of the lungs, which as I said above, had been inflamed the year before, was on the back part connected with the pleura. The pericardium contained two ounces of serum, and was consequently enlarged; and the right ventricle of the heart, had in it a little polypous concretion: yet the rest of the blood was not in the least concreted, although he had been dead seventeen hours. Having sawed open the skull, the dura mater was found tinged with a cineritious colour, along the sides of the blood-vessels. And when the dura mater was torn away from the crista galli, a little sanious serum burst forth: and about an ounce of limpid serum, came from the origin of the optic nerves. But the whole brain appeared sound; and we could not help taking notice of the unusual magnitude of the pineal gland.

3. This last article, which respects the ingenuity of the youth, you will understand was written when the pineal gland was believed to be the seat of the soul. As to the disease, it began with the pain of the head and eyes; the delirium, the vomitings, the convulsions, brought it to its acme, and the same convulsions, it would seem, by bringing on death put an end to it. Nay, perhaps this convulsion though occult, was the beginning of it. Since pain, delirium, and vomiting, might be the effects of slight convulsions: as the turgid state of both bladders, might be the effect of the delirium. For it is usual with delirious persons not to attend to the stimulus of the urine; and to refuse food, which by compressing the cyst would squeeze out the bile. Yet some part of this may have been forced into the stomach by the straining to vomit, and have given the aeruginous colour to the ejected humour. The same convulsion also left a sleepiness behind it, the brain being compressed round about; which sleepiness was frequently interrupted by the returning twitches of the convulsion. But was the serum, found at the anterior basis of the cerebrum, the cause, or the effect of the convulsion? 'Tis no matter which you believe; for whether we suppose that the latent cause of the convulsion, by constringing the vessels and giving a remora to the blood, was also the cause of the serum being effused; or that the serum being first extravasated, by irritating the meninges which lie at the lower part of the forehead and round the optic nerves, originally created slight convulsions and pains; the case will be sufficiently intelligible, whichever mode of explication we choose. For it is not necessary we should believe, that because the serum was limpid it was consequently harmless; since it is certain that salts which are the most capable of erosion, by no means affect the pellucidity of water, when dissolved. Though, in fact the serum was not altogether limpid, but in part sanious. But how that sanies is to be accounted for, we shall enquire in other histories of a similar nature; whether it was a true sanies, or rather an appearance of it only. I shall now give you the other history from Valsalva.

4. A man about forty years of age, had been liable many years to a pain in the right hypochondrium, which returned periodi-

cally, often attended with vomitings, and sometimes degenerating into the iliac passion, with delirium. He was also troubled with violent pains in his head, which were almost constant, and joined with a defluxion of serum upon his eyes. This man having drunk too freely of wine, was soon after attacked with his usual pain and vomitings. However, he got rid of both these complaints by an unction which an empiric had ordered to be applied to his belly. But he was immediately seized with a vehement heat in his head, both internally and externally: and the same unction being applied to his head, it was attacked with the most violent pain; and this pain was accompanied with a delirium and convulsive motions: which ceasing about an hour before death, or at least not being observable, he became apoplectic, with a difficult respiration, a foaming at his mouth, and a strong full pulse; and in this manner he died. The face of the carcass was pale, and the limbs contracted; but whether this happened from the great coldness of the external air, or from the foregoing convulsions, is uncertain. The pericranium about the sinciput, was found much thickened by stagnating juices, which were concreted into the form of a jelly. There was some serum betwixt the pia mater and brain, and some also in the ventricles of the brain. Having opened the abdomen, nothing appeared that was worthy of notice, except a little quantity of stagnant serum, and a hard liver.

5. These things which come last in the dissection, answer to those that went first in the history. The hardness of the liver shows that the periodical pain in the right hypochondrium, depended on the state of the viscus; for in such a state it must necessarily secrete a vitiated bile, which when collected in its cyst, would be plentifully poured out into the duodenum, and give rise to those pains in that intestine and the parts about it; and these pains by inverting more or less the muscular contraction of the stomach and intestines, often brought on vomitings, and sometimes the iliac passion itself. But when the pain and vomitings, which had become the more urgent as they were the more necessary to carry off the causes of the disorder, were increased by his late drunkenness, were suddenly suppressed, part



of these causes easily seized upon the head which was already weakened by its pains; and this part might possibly have been somewhat dissipated by the heat, had it not been imprudently repelled by the unction; for by this means, the morbid cause became inherent in the nearest membrane without the cranium, in the form of a jelly, and violently distended it; and within the cranium, by breaking in upon the parts mentioned, and by irritating the pia mater where it invests the brain and ventricles, first brought on those severe pains, then delirium and convulsive motions, and at length apoplexy itself. But if you choose to consider that serum as an effect rather than a cause, I shall not contest your opinion.

6. To these two histories give me leave to add a third, which, though it does not relate to a man, but a sheep, is far from being unworthy of our notice. Especially as Bonetus in order more fully to ascertain the seats of pain, has given us histories of sheep, and other animals in his *Sepulchretum*. This sheep avoided herding with the flock, and every day by intervals rolled himself upon the earth, nor would suffer his head to be touched, but avoided it by all possible endeavours. Valsalva observing this, and being desirous to know the origin of the pain, purchased and dissected the sheep; nor did he find any thing morbid elsewhere than in the brain: for when he first took it out from the cranium, a little acidulated water fell from that part, where the mamillary process approached to the os ethmoides. But a greater quantity of water was effused, when it was pulled away from the pituitary gland. Then, in dissecting the brain, when he came to the lateral ventricles, a follicle appeared therein, containing a good quantity of water, being made of a membrane, which seemed to be a production of the pia mater, except that some very small corpuscles were scattered through it, resembling the medullary substance of the brain. The roots of the follicle came out from the bottom of the right ventricle: and wheresoever they were, below this ventricle, there the substance of the brain, both in its medullary, and cortical part, was corrupted all round to a considerable extent. In short, the whole brain was extremely flaccid; nevertheless the disposition of the nerves was as usual. The examination being

carried on, that part of the os ethmoides which lies under the mamillary processes, was found to be so much eroded by the continual dripping of water from the brain, as to afford a free passage from the cranium to the nostrils.

7. An observation nearly of this kind you will find in Bonetus's Sepulchretum, or rather in the first century of the medico-physical histories of Petrus Borellus, not the thirty-seventh, but the thirty-eighth observation: in this I say rather, because Bonetus has omitted many things in his copy, nor has the other editor replaced them, contrary to the admonitions of Peyerus; so that by reason of omissions of this kind which I have observed, not only in one place, but in many, it were to be wished, that we had a new edition of the Sepulchretum, under the inspection of some diligent man, who would be at the pains of comparing the several articles, with the books from whence they were taken. A girl had been long troubled with a violent pain in the crown of her head, in whom Borellus saw an abscess full of the most limpid water, to the quantity of two pints, lying upon the nates cerebri and infundibulum. From so deep and so hidden a place, where the abscess could scarcely be found, did this pain reach principally to the crown of the head; and thus in some measure confirmed what we have elsewhere observed from Malpighi, but rendered doubtful what Archangelus Piccolhominus has advanced, that pains which are felt at the upper, or lower part of the cerebrum, are seated in the pia mater, which invests the lateral ventricles of the brain; for though this may sometimes be true, yet we must attend to what was just now hinted, that the other parts which lie deeper than the ventricles, and the basis cerebri, are invested with the same membrane also, and even under that; not to mention other things, that the transverse process of the dura mater is produced on both sides, quite to the borders of the sella equina; and that in so tense a state, that even on this account, it might be subject to the sharpest pains, either from the irritating nature of an extravasated humour, or only from a quantity of the same preternaturally overloading and distending it. And that other parts of the meninges, may be oppressed by congested humours, observations, which may be added to this first section of the

Sepulchretum, will also show, as for instance, those made by Behrenlius, and by Preuffius. For it happened to both these gentlemen, that scarcely had the knife reached to the lateral ventricles of the brain, but the included humour rushed upwards with a considerable impetus; so great was its quantity, and so great the force with which it urged the sides of the ventricles and the membrane that invested them! It is therefore not to be wondered at, if the pains of the head were vehement to such a degree, that one of the patients ran almost mad with miserable howlings; and that the other, though a woman, was seized with a fury, and threw herself headlong into a well. And Preuffius has shown, not only in this, but in two other observations, that where the pain was altogether on one side of the head, there the ventricle of that side only was distended: and where it affected one side chiefly, and the other in part, there the ventricle of the one side was much more distended with water than the other; and though the water was extremely limpid, it was not the less noxious than if it had been yellowish. For even the most limpid may contain an occult stimulus, as I said above, and as the history of Cohausenius also proves, in which the right side of the cerebrum; and this it was that suffered the most vehement pains; seemed as it were to swim in a great quantity "of acrid, salt, and perfectly limpid serum." Which, in other observations, as for instance that of Jo. Francus, whether it was limpid or not, seems to have been destitute of stimulating particles, and to have injured by pressure only: for although, upon opening the skull, water was universally found, yet the head had been affected only with a dull and heavy pain. But to return to the sheep: it is probable that the pia mater which covered the fundus of the right ventricle, had been pulled away from the substance of the brain, by the gradual congestion of the water, and formed into a follicle: and that some particles of the brain, which were torn away with it, gave that corpuscular appearance I have spoken of. As to the water, which was found to be somewhat acid on tasting it, this doubtless confirms what has been already advanced, that water effused within the cranium, may even sometimes act by vellicating, so as to give rise to disorders of the head. But in

regard to the corruption of a part of the brain, and the great laxity of the whole, notwithstanding that the animal lived and moved at the same time, I shall have a more proper occasion of discussing this subject hereafter. Last of all, the erosion of the os ethmoides must not be passed over without some animadversion.

8. As a passage was opened in this manner from the cranium to the nostrils, and consequently from the nostrils to the cranium, so if it should have happened that any animalcule had been seen in the brain of that sheep, our wonder would certainly have been less, than when we read so many histories collected in the Sepulchretum, speaking of earth-worms and other worms, flies, and with God's leave, even scorpions, having in every respect their natural appearances, as being found within human skulls, and thence accounting for the pains of the head. But some are without testimonies, some want a more diligent examination, which was certainly needful; and others, if they are compared with the books from whence they were taken, will be found to have a different meaning, as that which is produced from Fernelius. For if you turn to his description, you will wonder that Bonetus has been silent upon some things which ought not to be omitted, especially as the description is short; and, if you will weigh in the medical scale, the sense of those things which immediately precede, you will readily acknowledge that those two worms were found without the cranium, in the cavities of the nose. And it is probable that of the worms, spoken of in the scholia which are added to these histories, as discharged from the nose, some had lived in its cavities; but that others had crept from the stomach into the nostrils, while the patient was sleep. Nor is it uncommon for worms to grow in the frontal sinusses, especially in sheep, by the irritation of which they are much agitated: so that any one before dissection, might have supposed this had been the case with the sheep above mentioned, since he rolled himself in such agonies on the ground. Nay, and that it sometimes happens to men, to have worms form a nidus in similar places, and bring on pains of the head, even the Arabians formerly, after the opinion of the Indian physicians, delivered down in their writings, among them was Avicenna, who gives the symptoms and the cure of the

disorder. And these things are even taken notice of in those scholia; and moreover, we are referred to Aëgineta, book the fourth, chapter the 57th, as if he there "granted that pains were indeed excited by worms, but denied that they were generated in the brain." Yet they do not for this reason reject these incredible histories; but rather seem to confirm them from thence, because, as it appeared that worms might be generated from putrid matter in the nose, so they did not doubt but the same might happen from an abscess within the skull; being led on by an error easily pardonable in those times, when the ingenious observations of our Vallinieri had not yet demonstrated that worms found in the nose of a sheep were deposited by a fly; nor the celebrated Reaumur, in his incomparable history of insects, had confirmed it. Since then it is certain, that these worms are carried from without into the nostrils of sheep, and other animals of that kind; and since they are so frequently found in the nostrils of these creatures, but never in their brain, why should we on the contrary believe, that although they so seldom are found to exist in the nostrils of men, they are nevertheless often found to exist in the human brain? For there is not a passage from the nose into the brain of a living person, as there is from the nose to the frontal sinusses; but it is entirely stopped up with nervous fibres, and vessels and membranes, so that not even the smoke of tobacco, when drawn up, much less the smallest particle of its finest powder, or the smallest new-born insect that exists, can pass through. And indeed there was formerly a time, when it was affirmed from dissections, that the powder of tobacco, and much more the smoke of it, had entered the brain; and these observations you will in like manner read in the *Sepulchretum*. Yet even there you will see that one is rejected as false, that others are differently explained, and that all are immediately invalidated by a greater number of dissections of a contrary tendency, that are immediately put in contrast with them; and, if it were needful, many others of the same nature might also be added to these, and particularly from the books of the Caesarean academy.

9. What then? you will say; shall we believe that no little

animal, no soot, no snuff, was ever found within the cavity of the skull? Indeed, I suspect, that whoever asserts in his writings his having really seen such things, was certainly imposed upon, either by the tricks of some juggler, by chance, or by his own incautiousness. For you know how deceitful the hands of jugglers are; so that a person who was before aware of their designs, cannot with all his attention perceive, when they insinuate any thing into a place, which they pretend not to insinuate: how easily may a person be deceived, who is not only not forewarned, but intent on another thing? Nor is it altogether unlikely that we may be imposed upon by accident itself: as little insects may perhaps adhere to the sponge, which is generally used to wipe away the blood, upon opening the skull, or to dry up any extravasated humour; and these insects, by the frequent application of the sponge, may be left behind in the brain. But incautiousness would more frequently give rise to such assertions: for instance, when a slender polypous concretion, which is white and round, is taken for a worm; for it is very rare, and very difficult, for a true and living worm to creep so far as into the longitudinal sinus, by the way which I shall mention hereafter; yet in this sinus du Verney asserts, that a worm was found, whether he really saw it himself or not. Or the incautious observer may have been deceived by very small and crumbly concretions of matter, such as we often meet with in the male urethra at the orifices of the prostate gland, and even, as I have more than once seen, within the prostate itself; for these particles of matter exactly resemble the moist granules of tobacco, both in colour and form. Or it is easy to conceive, that a particle of snuff, which was lodged in the frontal sinus, may have been drawn into the cavity of the skull, by the saw or knife of the anatomist: for it is very certain, that the smallest dust of tobacco may get into the frontal sinus; perhaps may fly in by chance; or drop into it if the head were inverted; but may most surely be driven thither by the force of expiration. Or finally a narrow, winding, and for that reason less observable passage, might happen to reach from an external ulcer, into the cavity of this sinus: and by that means, either in the dead or the living body, animalcules might be transmitted.

Other things I designedly pass over; nor indeed is it necessary to bring more arguments, especially on your account, as you are skilled in the history of insects, and can very well determine from thence, whether weevils, gnats, flies, scorpions, and other animals, can live and thrive, notwithstanding they are shut up in a straight place, altogether deprived of air, and without proper nourishment to subsist on. And it is certain, that from the time in which natural history began to be much studied, and the several articles of it to be scrupulously enquired into, no more observations of that kind came abroad; or at least very few only, and those believed by as few persons. Nor did any discovery of this kind ever happen to Valsalva or myself, though former physicians assert it to have happened so often to them: and yet the number of heads which Valsalva has examined, is very considerable; and the number I have examined myself, is perhaps not much inferior to his. So that, if I should allow any one of these gentlemen to have really seen such appearances, without fraud or error; you must take it for granted that I do it rather from a reverence for their names, than from any conviction of my own mind. Nor need it surprise you, that after the most severe pains of the head, nothing else be said to appear but a worm, or animalcule found within the cranium, or seen to come out therefrom. For there are many causes of pain in the head, which either lie on the outside of the cranium; or if they do exist within, do not easily, or perhaps at all, fall under the notice of the senses. What if they are not sought after? for instance, when a worm coming out from the nose of a dying woman, is believed to have come from the brain; as if it were really impossible, that it should have crept up there from the intestines. What if other causes are sought after, when they have been already found in the brain? and yet the little worms which are observed a day after in the water, where a portion of the brain had been macerated, are accused as the causes of the disorder. Vehement also were those pains which two worms of the caterpillar kind created, before they were thrown out from the nose; yet those learned men Littré, and Maloer, who saw them, did not at all suspect, that they came from the brain; but accounted for them, by supposing

that they came from the frontal sinus, into which the very minute egg of the insect had been carried by the force of respiration. In like manner the learned Henckelius, when he saw two little worms like weevils coming forth by the same way, and freeing the patient from the most violent tortures of the head, judged that they had been perhaps drawn up into the cavities of the nose, by incautiously smelling to flowers: for the young of these animals are frequently harboured there, and it is not uncommon for us, to apply them close to our nostrils, while we make a full and strong inspiration. And before him Gahrlepius, when he saw worms discharged from the nose with the same good effect, because he perceived they were like those which are generated by flies, made no doubt of ascribing this offspring to a fly. And they were all in the right, because it was their opinion, that these animals did not come from any putrescent matter, nor were generated in the cavity of the skull, but proceeded from the small eggs or rudiments of animalcules, carried from without, into the recesses of the nose. It is not sufficiently agreed betwixt the two celebrated men whom I first quoted, what kind of remedies are to be applied, or in what manner, in order to bring out these worms from the nostrils. And this controversy it is the more difficult perhaps absolutely to decide upon, because the worms are of different kinds in different cases; so that it does not seem possible they should always be allured, or put to flight by the same things. But however this may be, it will certainly be of advantage to know from medical histories, by what methods they have for the most part been drawn out; to which histories you will add those things that are extant in the Acts of the Caesarean academy, already commended, and those in the *Commercium Literarium Norimbergense*, but especially what we read in the lectures of the great Boerhaave on his *Institutiones Rei Medicae*, where he mentions a girl cured by him, whose pituitary sinusses were all full of worms. But as they chiefly inhabit the frontal sinusses, which is indicated by the pain beginning, and being the most troublesome, in the region of either sinus, especially when joined with a sense of motion and gnawing; Littré therefore judged it proper, that if all other assistances failed, the aid of surgery should



be called in, as an operation on the frontal bone was neither difficult nor dangerous. And I do not doubt but he meant to recommend the same operation which Caesar Magatus formerly used, as I have heard from Vallisneri; that is, to trepan the bone quite into the sinus, and to take out the worm, which he had predicted was contained there, to the great admiration of the spectators; and thus he happily rid the patient of the pain, against which all other applications had been of no effect. And if Vallisneri had published the account of this cure from the manuscript of the author, as I hoped in my *Adversaria*, I should perhaps have learned among other things, not unworthy to be known, whether the same success attended the closing up of the exposed sinus, that had attended the trepanning of the bone; for how much difficulty there is to bring that about, Cornelius Celsus has already observed; and after him the surgeons commended by Palfin; and Palfin himself has also observed the causes of this difficulty, and the great mischiefs that arise from this sinus not being closed up; and in like manner that excellent archiater Nicolaus Rosenius, whom I saw while I was revising this letter; and from him you may select many things to be compared with Verheyen, who seems to speak of the same stage-quack as Palfin; and to be added to what I have already given out, upon that observation of Celsus. But if you would have further examples of worms found, as they say, within the skull, or thrown out from the cavities of the nose, you will meet with both kinds of them, among those things which Daniel Le Clerc has related, and intermixed with remarks for the most part: of the second kind you will find many among the instances taken notice of, or proposed by John Saltzman, who has neglected neither to mention the symptoms of them, nor the methods by which they were discharged.

10. But I will now give you three observations of my own, which are taken from patients, with whom pain in the head was either the first symptom, or at least, the most troublesome one among others. A beggar man was received into the hospital, who certainly had long before had a disorder in his head; he had always been silly, but of late so destitute of sense, that he threw away even the bread which he had begged. It appeared he had been

much liable to pains of the head, and at that very time laboured under obstructions of the belly. He dying of a kind of fever which came upon him, his body was brought into this anatomical theatre, in the year 1728, much emaciated, yet not discovering any signs of disorder in the belly or chest, if you except an obstruction of the spleen; but when the skull was sawed through, and the upper part taken off, it was observed that the dura mater was firmly attached to it on the left side of the forehead; and there for some space this meninx was not membranous, but had degenerated into a middle state betwixt a bone and a ligament, and formed the figure of an ellipse. Though the cerebellum was soft and flaccid, and the medulla oblongata not very firm; yet the cerebrum I found to be hard, as is frequently the case in idiots: notwithstanding there was a little limpid water in the lateral ventricles, with colourless plexusses, on the posterior part of which a few vesicles appeared, filled with the same limpid water. Finally, something yellow adhered to the anterior part of the pineal gland, which when compressed betwixt my fingers, I perceived to have a kind of sand intermixed with it.

11. These appearances relate to different affections, as I shall shew in the course of these letters: and that only, to the pain of the head, which was found in the dura mater. For whatsoever the cause might be, whether internal or external, of the dura mater being indurated, almost to the consistence of a bone, though no traces of this cause were obvious to me; yet it is easy to imagine, that as often as the blood, either by its plenty, or by its turgescency, or by its motion being accelerated through the head, put a force upon the vessels going to this part, it must necessarily be obstructed by that impediment to its course, and distend the fibres which surround the vessels of the dura mater. And you will see it is ascribed to this cause in the Sepulchretum, that those persons were "subject to the most miserable head-aches, in whom the two meninges for some space, often two fingers breadth, had coalesced in such a manner with each other, that the mouths of the vessels were entirely locked up." And it is probable that obstacles of this kind, as far as they oppose the circulation of the blood, or other juices, through the meninges, may sometimes give occasion

to pains which return periodically; as often, for instance, as a sufficient portion of juices, is obstructed, to cause a distention by its weight; and this obstruction will continue, till the fluids being vitiated thereby, shall irritate the meninges, and consequently bring on a contraction of their fibres; yet no sooner is the first portion of these obstructed juices thrust on by this new-excited force, into the narrow, and lateral canals, but a new portion succeeds, and is in the same manner delayed, and expelled; to this others also succeed; nor is there an end of the disorder, till the lateral canals are by these repeated impulses, so far dilated, that they no more resist the circulation of the juices. But pains of this kind are generally either the forerunners of a fatal event, or rarely, and with difficulty, admit of a cure; and the more so, as they more constantly recur at the same hour; perhaps because by this regular return it is proved, that the lateral canals more strongly resist the dilating impulse. I remember when I was a young man, I had a patient among my companions, in the place of my birth, by name Lawrence Bagattrini, who had been seized not long before with an external, but very violent hemi-crania, which returned every day at the eleventh hour, according to the method of reckoning the hours among the Italians. Whatever I did, had either no effect at all, or at least only that of shortening and alleviating the pain, for it still returned at the same hour; and if any little error, or irregularity, was committed, it returned with its former vehemence. Having for many days used all other remedies in vain, I at length got the better of the disorder, by means of a slight decoction of the woods; which gently agitating and impelling the circulating juices, threw the patient into sweats, and relieved him of his disorder. And Bal-lonius testifies, that the same method succeeded with him also, in intolerable hemicranias, that returned every day, at a certain hour. In the case of this young man, there was certainly something hereditary; for his mother, who was more than seventy years of age, had been seized a little before, with so great a pain in her head, that she lost the sight of one eye; yet she was still afflicted with violent pains, which recurred from time to time. But as these pains did not begin always in the same place, but

sometimes in the vertex, and sometimes within the nose, (so that snuffing up warm milk was of service) and did not return at the same hour, I found more ease in removing the pain of the mother, than that of the son; and being cured of her pain, the sight of her eye was by degrees restored. Among other things, bleeding was of service to her; but not so much what was performed by my order, as what she performed for herself, by untying the bandage from her arm in her sleep, by which she lost a considerable quantity: so that nearly the same success attended bleeding, even in a woman of that age, which Vallisneri afterwards remarked in one of sixty. But let us return to the dissections.

12. A young woman, who was the wife of a poor man, and the daughter of an epileptic mother, being extremely hot after a journey in the month of February, was seized with a violent pain in her head, and an acute fever. She had no delirium, but was often reservedly silent; and with these symptoms in three or four days she died. As she gave suck, and yet had her menstrua upon her, bleeding was for a long time deferred; but as she grew much worse, and yet the pulse and strength of the arteries was firm, half a pound of blood was taken from her foot, which was quickly and strongly coagulated; but it happened that her death immediately followed the loss of it. The head was brought into the theatre to finish the anatomy of that year 1738; but not the other parts, as I wished. The inside of the skull had a somewhat red appearance degenerating into brown; and the outside of the pia mater, where it covered the upper part of the brain, was smeared over with a yellowish kind of matter, not much indeed in quantity, but spread equally all over; its consistence was somewhat thick, and though it was perfectly inodorous, yet from the whole of its appearance, it seemed to myself, and to the other physicians and surgeons who were present, to be pus. However, we could not find any where, in the meninges, or cerebrum, which was discoloured, any traces of disorder, or any place from which we might suppose this matter had proceeded.

13. If it was really pus, shall we suppose that it was taken up, from some other part of the body, by the sanguiferous vessels, and translated to the head, agreeably to what is hinted of a

similar case in the Sepulchretum? Certainly for this reason, I should have been much more chagrined, that I was not permitted to examine the rest of the body, in order to have determined the question; had not the rationale of the cases been different, and other histories come under my knowledge, wherein, as in that of Valsalva before mentioned, no sanies was any where found but about the brain, which was itself in every other respect sound. Could this pus-like matter then, have its origin from the small, and almost invisible foramina, of the meninges, from which, in a natural state, only a little limpid humour, to moisten their surfaces, is discharged? Could it be pressed out by the force of the disease, as frequently happens to the glands of the rectum and bladder in the tenesmus or dysuria? Certainly, that the meninges were entirely free from disease, neither the violent pain of the head, nor the colour of the skull, where it was contiguous to the meninges, suffer us to believe.

14. Speaking of that colour brings to my mind the history of another woman, whose head I dissected in the beginning of the year 1717. Being first affected with the lues venerea, and after that with a fever, joined to severe pains of the head and delirium, she died of this complication of disorders in the hospital at Padua.

Her skull also, when it was opened, appeared of a blackish red in some places; and the dura mater, where it lay nearest to the upper and middle region of the lateral sinus on the right side, was much thickened, and perfectly coalesced with the pia mater, and even with the substance of the brain: the meninges and brain were in that part also semiputrid, and glared with a very disagreeable colour, which was composed of a yellowish, mixed with an ash like hue, especially in the cortical part of the cerebrum. Moreover, the external surface of the cerebellum was so firmly connected with the two meninges, that when I drew it out from the cavity of the dura mater, a part of its substance was left adhering thereto. But the extent of the adhesion was not so great as in the cerebrum, as it did not exceed the breadth of two fingers. The vessels of the brain likewise, which creep through the pia mater, were larger than they naturally are, and distended with a black blood, such as was also found in the sinusses of the dura

mater. And through the medullary substance of the brain, when dissected piece-meal, the sanguiferous vessels appeared to be very frequent in several places, and more distinct than usual. The lateral ventricles were full of a brownish water, with which colour also their surfaces were tinged. Finally, the pineal gland was firmer, larger, and whiter than common; and seemed to contain within it a kind of loculi or cells. I will not, however, conceal a remark, which may be joined to that curious observation extant in the Commentaries of the imperial academy at Petersburg; I mean, that from the birth, or at least from early infancy, the woman had this peculiarity in her skull, that the right side posteriorly, had a larger curve outwards than the left; for which reason its internal cavity, and the hemisphere of the brain contained therein, were evidently larger on that side than the other. The same circumstance occurred to me also in another woman, and seemed the more worthy of attention, because the whole cavity of the skull was made oblique and winding; the right temple being more hollowed, the left more contracted; and *vice versa* the right side of the occiput being more contracted, answered to the left, which was more hollowed. But though in this woman also the lateral ventricles were full of a turbid water, yet as this history does not immediately relate to our present subject, we shall for that reason give it you hereafter.

15. For I do not know whether this woman had been subject to pains of the head; nor yet whether the whole history was just now related in full, had been troubled with them before she was afflicted with a fever: notwithstanding, I know very well from other observations, "that a misshapen figure of the head is believed to be of great consequence, in bringing on obstinate pains;" which words are copied in the Sepulchretum also, but the author's name, to wit, Rolfinc, through neglect, is omitted. But to return to the history described. If this woman, and the other young woman spoken of above in like manner, had been men, and almost continually employed in smoking tobacco, that brown and almost black colour observed on the inside of their skulls, some would have thought, and especially formerly, very easily to be accounted for from thence; that is, from the soot and

dregs of the smoke being drawn up and harboured there; nor indeed did they neglect to account for it from thence, as we have shewn by what goes before. We however, as some redness was mixed with that colour, did not hesitate to attribute it to the stagnating blood. For though the woman laboured under a lues venerea, yet there was no where any caries in the skull, which from the sharp pains might possibly have been suspected with some reason; although the external surface of the head gave no mark of it either by colour, or tumor. And this is evident from many observations, but especially from that of the beautiful strumpet, which I remember to have heard from Novesio at Bologna, who afterwards published it. The thickness then of the dura mater, and its coalition with the interior lamina of the skull, is sufficient to account for the remora of the blood in the small vessels, as we shall shew elsewhere. And I think it is equally sufficient to account for those pains, even from the arguments which were above set forth.

16. And that you may more fully understand, how coalitions of that kind, by being an impediment to the blood, may bring on pains of the head, remember, that as some of the sanguiferous vessels are veins, and some arteries, the blood which is carried through the latter, will, when it meets with an obstacle, whereby its progress is made slower, not only injure, by distending the fibres, but also by encreasing the strokes of the vessels. That is to say, as many arterial pulsations as there are in the meninges, so many strokes will they receive; and these strokes will be so much the greater, as the transit of the blood is more difficult. Thus Brunnerus attributed the violent pains of the head, in a man whose dura mater was beset with many verrucae of the bigness of a pea, which were scattered up and down, but especially about the ramifications of the arteries, to the several strokes of these vessels; although he considered the force of the distension only, and not of the percussion. However, not only coalitions, by diminishing the capacities of the vessels, which pass through them, but also whatever by pricking and vellicating, or compressing, can produce the same effects, will give occasion to pains of the head.

By pricking did that sharp bony particle, situated betwixt the meninges, give occasion to pain, of which you will read in observat. iii. an. vii. dec. iii. Ephemer. Caesareae Nat. Cur. Academ. And by compressing, that interior exostosis of the cranium, described in observation ccliii. dec. iii. an. x. the blood being thereby so obstructed in the meninges in like manner, that they were almost a finger's breadth in thickness, and had the appearance of fungous flesh: as also that in cent. vi. observ. xxi. which by the remark added to it, does not stand alone; but especially that which is extant in observation xcix. vol. ii. of the Acts of the same academy. And I designedly collect you several examples from the less ancient books, because I see that many things from those books which were published before the second edition of the Sepulchretum, have been deservedly transferred thither.

17. Nor do we want examples taken from other observers, to add to these; two of which I will mention, as they are not inelegant observations, and are much to the purpose of the above dissection of the woman; for they shew, that too great a quantity of blood distending the vessels within the skull, will create pains of the head. One example is that given by Cowper in his English Anatomy of the human body; or if you have not this book, in the Acta Erud. Lips., and another you will read in the commercium Literarium. The first example is of a man, who from his youth had been liable to the pain of which we speak, in a violent degree; and in him the vessels of the dura mater were so distended, as to equal the bigness of a goose-quill. And lest you should imagine that this happened on the attack of the apoplexy, which was his late and final disease, I will prove to you that this phenomenon was of a very early date; for the sulci or beds of these vessels, in the internal lamina of the skull, were so deep and so large, as to answer entirely to the thickness of the vessels themselves. And to this observation you may also add a similar one of Bajerus. The second example is that of a woman, who in like manner had been subject from her youth to great pains in her head; and these were always encreased in proportion to the encreased quantity or rarefaction of the blood. For in her the right kidney being out of its proper situation, and so compressed the aorta and vena



cava against the lower vertebrae of the loins, that where this vein received the blood of the left iliac, a varix was formed, the diameter of which exceeded the diameter of the cava in almost a double proportion: and from this it is manifest, that in proportion as the blood was impeded in its free course to the lower extremities, the greater quantity must have been consequently carried to the upper parts, and to the head itself. And you easily see what these examples tend to prove; to wit, that the quantity of blood with which I saw the vessels of the meninges, and the minute vessels of the brain, distended so as to enlarge their peripheries, was sufficient to account for those severe pains of the head, with which the woman had been affected.

18. As to the other things which the history contains, some, for instance the circumstance of water being found in the ventricles, I have explained already; and the remaining circumstances will be explained elsewhere. For, as I said in the beginning, pain of the head is generally complicated with other disorders. Thus I have given you what occurred to me at present concerning this disorder; and shall go on to consider others in the same manner, if these first observations should not be disagreeable to you. Farewel.

#### LETTER THE NINTH

#### WHICH TREATS OF THE EPILEPSY

1. The vertigo, which is treated of in the Sepulchretum, in the next and eleventh section, frequently degenerates into an apoplexy, or other soporose disorders; and many thus affected, at length, die vertiginous. And as this is shewn by the observations produced in that section, and especially by the first and eleventh; so also it is confirmed by others given in the former letters. And the case being thus, I think it is better, that without any repetition of these things here, we go on immediately to the twelfth section, which treats of a disorder into which the vertigo often degenerates, that is, the epilepsy. For vertigoes, as Galen has rightly taught us, "approach very near, in their nature, to the falling sickness, and that which they call apoplexy, so as to precede both the one and the other." Of an epilepsy, which was

of itself mortal, as it seems to me, Valsalva has left but one observation only, and that very short, which runs after this manner.

2. An old man of sixty years of age, being subject to epileptic fits, was seized with a fever. This was suddenly followed by an epilepsy, of which he died. Between the dura and pia mater, besides a quantity of serum everywhere effused, a portion of extravasated blood was also found on the side: the ventricles were also filled with serum, and in them the plexus choroides had their turgid glandules.

3. If you impute that portion of extravasated blood, as it most probably ought to be, to the last epileptic convulsions, which, as the fever had constricted the swelling vessels, might easily bring about some rupture of them, where they were more lax, and this, as it is easy to believe, apoplexy and death were immediately the consequence of; yet the serum will still remain, to which you may perhaps attribute the epileptic paroxysms, or at least this last of them. For you have, even in the very section we are speaking of, and in its additamenta, histories of epileptic patients, not unlike this, where serum was found to be redundant within the cranium: the most ancient of which is that sixteenth of Hippocrates, transferred from sheep, and "especially from goats, who are very frequently seized with this disorder," to men. And notwithstanding these histories are in great number, (although, by turning over the page, you will perceive, that the fifth is the same as that which is produced under number ten) yet I think it will not be ungrateful to you, if I add others, one of which was made in the last age, and the others in this. The former is one of Michael Gavassetti, a physician, indeed, but not professor, at Padua, as some writers call him. "I remember," says he, "that I saw the illustrious cardinal Commendon suffer sixty epileptic paroxysms, in the space of twenty-four hours, under which nature being debilitated and oppressed, he at length sank, and died. His skull being immediately taken off, I found that his brain was affected with a disorder of the hydrocephalous kind." And of three, which the learned Balthas. Waltheiri sent to me from Venice, on the last day of March, of the year 1727, I will mention two in particular,

which come nearer to the nature of that related by Valsalva. For the histories are of two old women, even of a greater age than the man of whom Valsalva gives the account; one of whom had been long subject to an epilepsy, and the other, having laboured under an anasarca, was seized with three violent epileptic paroxysms on the same day that she died. Both of them, indeed, had water betwixt the brain and pia mater, and in like manner in the ventricles. Both also had many vesicles, in the plexus choroides, tumid with water; but the first had all these circumstances in a much greater degree than the last. For though the lateral ventricles of the last were almost full of serum, yet in the first, every part was so distended with the same kind of serum, as to be almost ready to burst; wherefore, upon the slightest touch, they poured forth a great quantity thereof. Yet water is often found in far less quantity in the cranium of epileptic patients, even in the cranium of infants themselves, in whom that it is found in great quantity at other times, the same section of the Sepulchretum teaches. In the seventh observation, for instance, in a girl of a year old, you see that it was found to the quantity of five pints; whereas in a boy, who was a little older, it was scarcely to the quantity of two ounces; as that diligent observer, and at the same time celebrated physician, Hyppolito Francesco Albertini related to me, in the following manner, when I resided at Bologna, for the sake of prosecuting my studies.

4. A boy seventeen months old, the first-born of noble parents, having been conceived during an uneasy state of mind of the mother, and his father having but weak nerves, had a head bigger than natural, and for that reason heavier, his eyes being heavy and sad, one part of his thorax depressed, his legs not sufficiently firm, and his flesh flaccid. This child having been before, when he had scarce arrived at a full year, taken with disorders, that made it necessary to lose two ounces of blood, and presently after being freed from those difficulties, having suffered somewhat of an epileptic disorder from dentition, last of all, when one of the dentes canini began to come forth in the upper jaw, shewed, that the aphorism of Hippocrates is true, which asserts, "that fevers and convulsions are most threatening to children when the dentes

canini are cutting through the gums.” For being first seized with a fever, then with a sudden and very violent epilepsy, he was found by the physicians who were called to him, already to have a stertor, and to lie without the least signs of a pulse. In this extremity, the physicians ordered the neck, temples, and nostrils, to be rubbed well with oleum fuccini, and applied to his nose, not the spirit of salt ammoniac by itself, but only a slight odour of it, and pigeons opened alive to his feet: by which means the disorder remitting a little, and the arteries beating again, they did not hesitate to take blood away from his arm, to the quantity of three ounces. From which respiration, indeed, became less difficult; and the boy returning, as it were, to himself, lifted up his little arm, and rubbed his forehead. But nevertheless, as his head, which was oppressed by the force of the disease, was not at all relieved, and as even when the fingers of the physicians, for the sake of the experiment, were moved close to his eyes, they nevertheless continued open, and discerned nothing, it was concluded that the child could not be saved; who accordingly died at the sixth hour from the beginning of the fit.

The cranium being opened by the very learned physician Peter Molinelli, not more water appeared than I said before, and that a little bloody, as well in the cerebrum, which was very soft, as every-where about it, but especially at its basis, perhaps in consequence of the dissection. The thorax, in that part which was narrower than natural, contained a little extravasated blood; and the part, by which it had issued from the lungs, seemed to be, in a manner, eroded, and corrupted.

5. You will ask, perhaps, whether I believe, that such a small quantity of water could excite such great tumults, when even from the Sepulchretum itself, you learn that Fernelius, and Erastus, had declared, that an epilepsy was not often brought on from a large quantity, but rather soporose disorders, which our former letters also confirm; and even that Willis and long before him that Henricus Petraeus, had brought arguments from the sudden attacks and solution of an epilepsy, from which he was led to suppose, that it could never happen from water: and in those cases it does not seem possible to disprove it, in which nothing

at all preceded the attack, or succeeded the solution, that could shew the brain to be in any manner hurt, or debilitated. Yet it does not follow here, that epileptic disorders cannot be brought on from water in other cases, and that even in small quantity, as I shall declare below, after having first produced some examples of these cases, which disagree, one with another, in many circumstances, and in which I shall readily acknowledge, that there was even no water at all. For, first, I have formerly heard of a nobleman of Padua, who was sixty-four years of age; that when he was in his forty-second year, being seized with violent anger, and almost at the same time with his first epileptic paroxysm, he fell down; and after a long time having passed between, when he had by chance seen the person with whom he was angry, that he fell down again; and after that, the same happened to him, even when he did not see the person, and that repeatedly, till in the two, or three last years, he was only sometimes attacked with a little kind of privation of the senses; whether because the length of time had now broken the violence of the disease, in great part, or the powder of tobacco, which, according to the common custom, he had begun to take by way of snuff, had diminished the causes of the disorder; for by this means, indeed, much moisture had been discharged from the nose. But although you may believe, that this was added to the first cause of the epilepsy; yet you will certainly not imagine, that it was then the cause of that disorder, when the sight of a person whom he hated, suddenly laid prostrate a man in the most sound state of health.

6. But when I attended upon that great master in the healing part, whom I commended above, Hippolito Francesco Albertini, I remember that a noble young gentleman, among the citizens of Bologna, and now a most honourable senator, being seized with an epilepsy from a fright, which frequently recurred, and using, on that account, a drink, in which the herb betony, primrose, baum, and carduus benedictus, had been boiled, adding a few drops of the spirit of human blood, he began, not only to make more water than in proportion to what he drank, but even to the quantity of ninety ounces every day. But as neither the discharge of so great a quantity of water, nor the greater laxity of

the belly than usual, diminished the number or vehemence of the attacks; Albertini turning to me, said, though we should by art draw off all the serum from the body of this patient, it would be in vain, since nature profits nothing thereby. You therefore see, that this disorder was neither primarily, nor secondarily, produced by serum, which the cure also confirmed. For the cure was completed within forty days, not by drawing out the water, which had not been intended, even in the beginning, but by quieting the tumultuary motions with sedatives. Twice every day oil was injected by the rectum, but in its simple state, that it might do nothing but relax the distended nerves, and keep them in an undistended state. For by those accessions it was found, that the internal and external nerves, were irritated much more than the cerebrum; and that the patient found much benefit while he was agitated by the disease, if the whole spine was rubbed with a soft hand, and anointed with oil, recently expressed from sweet almonds, in which earth worms had been boiled, and to which a little oil of amber had been added. And to those remedies, which the patient took inwardly, opium was added with advantage. And they were such as are judged proper against diseases of the nerves, and commonly known: for Albertini did not attribute much efficacy to secrets; which I could wish were circulated in smaller numbers, and of a more certain effect. Among these arcana I have lately heard much extolled, a small stone, which is generated in that little animal, that we call among the Italians, *lumacone ignudo*, or the naked snail, yet not so recommended as to cure all epileptic patients; and I have heard that those paroxysms which have their origin from fear, as those now in question had, were much less frequent, from the time that a warm liquor made from the flowers of the herb verbascum, or torch-weed, in the manner of tea, began to be drank by the direction of a Frenchman. Yet very often, those things which have carried off a sympathetic epilepsy, are cried up to take away also an idiopathic one, not less vainly, than unskilfully and rashly, and hence the number of arcana is uselessly multiplied.

But the medicines, which Albertini made use of in this case, leaving off that which proved too diuretic, were reduced to that

of the human skull, which he ordered to be rasped, and beaten in a mortar, and to be moistened with the water distilled from black cherries, then to be dried in the shade; and this process to be repeated often, till it was reduced to a pollen, or impalpable powder; for what they call magisteries, he with justice disapproved: but from that pollen lozenges were formed, opium being added to them, and distributed with such care, that scarce more than one grain was in all those which were to be taken at intervals through a whole day.

Perhaps you will ask, whether he took away blood? and blood he did take away, as soon as ever the first attack was at an end, which he would have done, even if no epilepsy had followed so great a fright. For he used this practice, I believe, because, after his friend Malpighi, he had observed, as I also have sometimes, that after such an affection of the mind, the blood becomes prone to concrete; from which circumstance many and various disorders arise, and perhaps because, as often happens, some traces of a depraved disposition remain impressed upon the brain therefrom, which are discovered by unreasonable fears, or terrifying dreams: and blood-letting, as it resists that proneness to concretion in the blood, so it is useful to overcome this kind of convulsive difficulties in the brain.

And he wondered, if at any time he heard, that there were any, who, contrary to the admonitions of Caelius, excited sternutation in epileptic patients, with the doubtful hope, either of changing for the better, the motions of the spirits, or of moving forwards the blood, which was almost stagnated in the vessels of the cerebrum. For who could answer for it, that the motion we would wish to quiet, would not be made worse from thence? And can we suppose, that the blood, which is probably retarded from the fibres being convulsed, in diseases of this kind, will have its passage expedited from these fibres being still more irritated? Wherefore, he thought this kind of remedy rather more proper in those apoplexies where the passage of the blood was obstructed, by reason of the fibres being extremely relaxed; although, at the same time, he thought it a remedy of such a kind, in general, that it was indeed very rarely to be recurred to, by skilful physicians.

Nor did he himself, certainly, apply any thing to the nostrils of epileptic patients, besides oil of amber; for those medicines which are called spirits, he referred entirely to apoplexies of the kind I spoke of just now, and similar affections, by reason of the injuries observed therefrom, in those whom the ancients called warm constitutions, and who laboured under disorders from a warm cause; especially in hysterical women, in whom, when seized with an epilepsy, perfumes of that kind, he had always found, left at least a fullness of the head behind them, if nothing more.

But he chose rather that the patient's head, when attacked with this disease, should be laid very high, and preserved so, as much as could be possibly done; for by this means the humours were less accumulated in it, and the breath was more easily drawn: and he replied to those who perhaps objected, that thus the foam was with more difficulty discharged from the mouth, that it would be formed in the mouth in less quantity, inasmuch as the head and lungs would be less loaded; and, indeed, that this foam did not always, as is generally believed, proceed from the lungs, though Pechlinus denies it, but was rather made from the saliva being agitated in the mouth; for he had observed some little streams, as it were, of this fluid, without any foam or froth, frequently flow down from the mouths of epileptic patients, when the head was by chance inclined to the other side. But doubtless, while I am led by a grateful regard towards the memory of my preceptor, and by your affection for him also, which I am fully convinced of, to pursue his methods and practices in the art of healing, I am carried away too far from the present design.

7. To which, therefore, that I may return, I will just skim over, in as few words as I shall be able, those many things which I have observed, for a long time, in my fellow-citizen Anastasio Poggi, a grave and worthy priest. He was in this sixty-eighth year, of a habit moderately fat, and of a florid complexion, when he was first seized with the epilepsy, which left behind it the greatest slowness of pulse, and in like manner a coldness of the body. But this coldness of the body was overcome within seven hours, nor did it return any more, though the disorder often returned; but the slowness of the pulse still remained. The first epilepsy had



succeeded to a pain of the right hypochondrium, which was resolved by bilious dejections: the other paroxysms, which were slighter, generally succeeded to the sensation of a kind of smoke, ascending up to the head from the hypochondria, the fullness of which parts was continually troublesome to the patient, and was certainly encreased from the ingesta, but especially from liquids. And this being the state of the case, and as the pain of the head, and all the marks of its being affected of itself, were absent, the senior physicians, who had not wished for me to be their companion, in the cure of this refractory disorder, less than the patient himself, made no scruple to pronounce, that it arose from the irritation of the hypochondria. And indeed, as you have it also in this section of the Sepulchretum, there is extant in Galen a history of a certain grammarian, "who, having abstained too long from food, became epileptic, from no other cause than bile," and examples are very common of adults, not only of children, who have been troubled with epilepsies, from worms harboured in the intestines. And to this purpose also is that observation of Spigelius, on a whelp thus killed by worms; not very unlike to which, is that formerly written by me to Vallisneri, and by him published. And you know that this disorder often arises, also, from other viscera of the belly being diseased, which the section, that I have already quoted, confirms.

But although that kind of cure was applied to my fellow-citizen Poggi, with my assent, which was proper to open, cleanse, and relax, the hypochondria, yet, nevertheless, the accessions still returned frequently; so that we now began to fear, lest the head itself had also contracted the injury, especially as, upon a very quick turn of the head, the epileptic insults recurred, and left a sense of weight with stupidity in the head; and frequently some blood came, together with the mucus, from the nose. Wherefore, as in the beginning, they had already drawn blood once and again from the arm, nor had omitted to give such things as are generally of use to the head, I persuaded them to let blood be taken away from those veins, which lie about the anus also; and that several things should be given internally, which are recommended as extremely proper against this disease, by the most excellent

physicians. These remedies, however, were of no advantage; but the bleeding, whether it relieved the head, or rather those viscera which are served with blood by the vena portarum, was so far of advantage, that for a short time the paroxysms were quiet. When, therefore, they returned again more frequently, it was of use to make the patient sit up, sometimes to rub the lower limbs, and sometimes to tie them alternately with bandages thrown round about, and sometimes to fix cupping-glasses without scarification, and presently to vex the patient by taking them off; for thus he seemed to have a longer intermission from his paroxysms. And it was even assured, that when they sometimes attacked him much more often, the spirit of salt ammoniac, applied to the nostrils, had driven them away as they were coming on; or, even when they were already, in a manner, begun, had suppressed them, although the patient was entirely without the power of smelling. They were, for the most part, very short, but by no means slight. For distortions of the eyes, agitations of the limbs, and a suspension of all the senses, always accompanied the attack: oftentimes there was a strangulation, and that sometimes joined together with a stertor; and even, now and then, an involuntary efflux of urine attended. But he was exceedingly bad that day on which the solstice happened, and in like manner, that on which the eclipse of the sun happened.

And though you may suppose this might be by chance, yet you cannot suppose it merely accidental, that when the quantity of urine was either naturally or artificially encreased, the epileptic paroxysms not only became not slighter, but were even very frequently exasperated. For we were obliged to have regard to this excretion sometimes, when a sudden difficulty of breathing roused the patient, as he was beginning to sleep, and compelled him to sit up; which symptom, doubtless, gave us some suspicion of a dropsy of the thorax; and the more so, because the patient told us, that his right leg had, for a long time past, been accustomed to swell a little with water, and that even then, which, when he told us, we examined into, the swelling was ascending up the thigh. But it was easy to encrease the quantity of urine, by obvious and innocent remedies, and therefore to diminish the

tumour, and that suspicion, which was afterwards entirely removed; but not so the force of the attacks, which, from the increased afflux of the urine, and that of itself, sometimes opaque, and blackish, was so far from being weakened, or diminished, that even on the contrary, as I said above, they grew stronger and stronger. When these things, and others, which for the sake of my promised brevity I pass over, were of no effect against the inroads of this disease, and even such as had been sometimes useful to retard or suppress them, as I said above, were now of no advantage, as they did not continue to afford these effects; there was one thing, however, which was constantly of service; I mean opium, given at the beginning of the night, in the quantity of half a grain. For the frequency and force of the insults, and added to these also, obstinate watchings, so weakened the patient in other respects, that we were under a necessity of gaining a truce by some means or other. And by this means, good nights, and easy sleeps, were procured to the patient: and so far was his head from being made heavy, or dull, by the use of this medicine, that even the heaviness and dullness, left behind by the daily attacks, were by this means taken away; which otherwise, that is, when the use of the opium was intermitted, continued, while the former restlessness and watchings also oppressed him. And, indeed, after he had passed a night of that kind, which was far more troublesome than the rest, when to the greatest rarity of the pulse, which I mentioned in the beginning, an inequality had suddenly been added, so that very often they were perceived to be even much more rare, then not more so, than usual, and presently much rarer again; which symptom made us the more uneasy, because the disease, at that time, was wont, first of all, entirely to obscure the pulse, and then immediately to begin its attack; and when we had tried all the remedies, recommended to dissolve, and promote, the circulation of the blood, in vain; upon giving the opium again, the quiet nights again returned, and diminished that inequality of the pulse: and, by the continued use of opium every night, it was entirely removed, and even the former rarity was diminished.

But, perhaps, you will suspect, whether the rarity of the pulse

be, in fact, a very uncommon symptom, to remain after an epilepsy, in hypochondriac patients, when you shall have compared this observation of mine with that of the celebrated Gerbezius, which describes the pulse of a strong hypochondriac man "who was now and then subject to slight epileptic paroxysms," even when he was in health, "as being so very slow, that before the subsequent pulsation followed that which went before, three pulsations would certainly have passed in another healthy person." But to return to my subject; after that no fit had now returned for thirteen days, and the use of opium was intermitted, the first night indeed was not bad; but the following ones, by reason of the continual watching, and restlessness, and at length by reason of that difficulty of breathing, which I spoke of above, were exceedingly troublesome; so that we were obliged to have recourse again to the opium, in order to procure quiet nights, which nothing but opium would procure. And, to comprehend all in a few words; that the attacks of the disease, from being very frequent, as they had happened every day, in the month of June, had been so far reduced in their number, that but one happened in July, one in August, nor more in September, and after that none in the two next months at least, and upwards, till I departed to teach medicine publicly, we judged was owing to the use of opium, given opportunely, sometimes every night, sometimes every other night, and at length at the intervals of many nights. For by that medicine we were able to appease the tumultuary motions, which arose, and frequently by a very manifest sensation, from the hypochondria, to the thorax, and head; and by this means procure a truce, both for nature and art; and this gave us sufficient time to cleanse and confirm the hypochondriac viscera, which we had determined to do, in the beginning, but in vain attempted, among those first continual tumults, with which the patient was harrassed: and from these viscera alone, and not from water being redundant in the brain, that these sudden commotions arose, this history, or I am much deceived, indeed, evidently shews.

8. But if you desire other examples besides these, of the epilepsy arising suddenly, either from passions of the mind, in a

healthy man; or having its beginning, in a part remote from the brain; you will find many such, among those cases collected by Schenk: although it so ancient an observation, of its beginning, "either from the side, the hand, or the foot," that particular mention of it is made, as being then more easily curable, in the second book of Predictions; which if it be not one of the books of Hippocrates, is at least the work of so ancient, and so much esteemed a writer, that this passage of his book has been transferred into the writings of Celsus, in the following manner: "Where, in an epileptic person, the sense of the approaching fit begins from any one part of the body, it is best that it begin from the hands, or the feet; next to these from the sides: and worst of all from the head." The force of which ancient prediction, Willis, perhaps, did not sufficiently attend to, when he contended that those very epilepsies, which seem to begin in a part very remote from the brain, do nevertheless "not uncommonly" take their origin from the brain; as you have it in the Sepulchretum. Which though it may sometimes happen, yet that it happens much less often than he imagines, not only the prediction I have mentioned, as it is confirmed by physicians, teaches, but very frequent observations, if they are rightly attended to, sufficiently prove. And that we may not draw these observations from any other source, than that of the Sepulchretum; turn, I beseech you, to that observation on the epilepsy by Tulpius, which was excited "by the mere pressure of a finger upon the region of the spleen;" then turn to another, and a third also, of the same disease, beginning from the sole of the foot, or great toe; so that if a tight bandage was timely thrown round the leg, the disease did not proceed: if not, it finished its course to the upper parts, and through the whole body.

But there is also an old history, in the books of Galen, which is likewise taken notice of, in the Sepulchretum, although he did not say that the disorder arose from the "great toe," as you will read there, and in the writings of Saxonia, but that it had its origin "from the internal part of the "leg;" and he also subjoined, what makes much to the present question, but is omitted in the Sepulchretum, that the paroxysm, which was wont to attack the patient, every day, was prevented from returning, after other

things, that were prescribed by the physicians, "by binding the limb in the middle of it, above that part, to wit, which was affected with the primary disposition." Other observations I pass over: but lest you think these too few, take thus, what I heard even from one physician, Ramazzini, formerly my colleague and friend, when I happened to be present at one of his public lectures; that he had seen several epileptic patients, whose paroxysm beginning from the foot, and ascending upwards, was easily restrained by a bandage being placed upon the leg. In all these examples, and others of the same kind, can you now believe, that there is room for the explication "not uncommonly" of Willis, when you see, that by the communication being timely intercepted, betwixt that part and the brain, the rising disorder was checked and prevented; but that this communication not being cut off, neither was the disorder restrained? For, if it had its origin from the brain, why did it always go to that part first? or if it could not go to this part, by reason of the bandage being tied about the leg, why did it not go to some other? And that not the least doubt may remain, why does the disorder return no more, if any one take away the cause thereof from that part? Examples of cures of this kind, are extant in the writings, both of the ancient and modern physicians. Let it suffice however, from amongst them, just to point out Marcus Gatinaria, who not only directs it to be done, but even confirms it by producing his own observation: and among these likewise, that physician, of whom the celebrated Van Swieten speaks, when he very learnedly teaches how to distinguish the cases, in which Willis may be followed, from those, in which he ought not to be followed, since there certainly are those, in whom the beginning of the epilepsy can by no means be believed to be in the brain; those numbers, for instance, of this kind, which we have actually produced, and are more than of any other; in whom, to use the words of this celebrated man, "the signs of the incipient paroxysm are always observed in the same part, and not in various parts," or in different parts at different times. Therefore, if the beginning is not within the brain, neither can it be attributed to water stagnating there.

But, as I have not only candidly acknowledged, but even confirmed, much more at large than was necessary, if I did not write to you, who particularly require it of me, that there are many instances of the epilepsy, in which the disorder is neither brought on from water being extravasated in the brain, nor does it even seem possible it should be; so I think it must be granted to me also, that, on the contrary, there are cases, in which it may even happen from a small quantity of water: and this I will demonstrate after the next observation.

9. A young man of eighteen years of age, having lived in marshy grounds, where his business was to cut down the weeds, with which the coopers stop up the chinks of their vessels, fell, naturally, from his manner of life, into a dropsy, and that a general one. When he was brought into the hospital at Padua, having taken some diuretics, his swelling was somewhat abated; but then he began to be seized with an epilepsy, with which he had never been troubled before: the fits of which frequently returned, on the last seven days, joined with a silliness, and a propensity to sleep, to which, at length, an acute fever was added. Under such a complication of disorders, he could not but sink.

The head was the only part which underwent a dissection, in that place, on the eighteenth of March, in the year 1741. The face was very tumid, from water lying in the cellular membranes. The skull being taken away, and held up to the light, shewed the borders of all the bones, which form the true sutures, to be transparent, to the breadth of half an inch. All the vessels that were within the cranium, contained but little blood; if you except the lateral sinusses, which contained a black blood. Under the pia mater, there seemed to be something like jelly, mixed with bubbles of air. The cerebrum, but not the cerebellum, was found to be harder than it should be: yet the fornix was lax, and the plexus choroides, which were pale, were still more lax; so that the membrane lying betwixt the right and the left, might be torn by a mere touch only. The anterior part of the left corpus striatum, where it looks towards the right, being compared with that which answered to it, on the other side, was found to be more protuberating, even at the first glance of the eye; nor was there

any danger of deceit in this matter, since the brain, according to my general custom, was dissected in its natural situation. This part, however, was externally sound, and as far as I could judge, internally also; although, at the same time, I ought not to conceal, that the cineritious substance, which is interposed with the white striae, or lines, seemed to my worthy friend Mediavia to be, as it were, somewhat porous. Nor did the septum lucidum, nor the pineal gland, nor any part whatever of the brain, which was diligently dissected, shew the least disorder besides those, unless that a little water, of a yellowish colour, was found in the cavity of the lateral ventricles.

10. You have here the history, just as I committed it to paper, when I returned home, as is my custom: for I distrust my memory on such occasions. Take care, therefore, how you believe that I am easily deceived thereby, if at any time you see any one of my observations proposed in a somewhat different manner from what is related, by any one of those who were present at the dissection: yet, why this circumstance should happen to the present observation, I can rather wonder, than understand.

But I do not imagine, that you expect I should shew you all the causes of so many diseases, and even of the death of this young man, when you observe, that no part but the head was brought to me to be dissected; and even if the whole body had been dissected quite through, that the cause of the acute fever, for instance, which is, at least, not less fatal than the others, among the number of which it is, generally escapes the eyes of anatomists. It remains, therefore, that we consider, from those appearances which I found in the head, whether there be any thing which we may, perhaps, with probability, suppose to be the cause of the epilepsy, joined with a silliness, and proclivity to sleep. And I say, there is something which may, perhaps, be supposed: for that it was really the cause, or was not the cause, is neither my business, nor yours, nor that of any other man, to pronounce, in cases of this kind. Therefore, setting aside the transparency of the skull, about the sutures, for the state of these sutures was far different from what is believed by many to be the cause of epilepsies, and my observation on that subject is, perhaps, less to be attended to



in this young man; I suspect, that in almost all the other appearances which were observed, if not the cause, at least the force, which was sufficient to assist the cause of that epilepsy whereof we speak, might be sought for, and conjectured: but I suspect, that the chief cause may be placed in the water which was found in the ventricles, whether it was in small, or in great quantity, in the living body. It is probable, however, that there was much water in a dropsical person: which the paleness of the plexus choroides, in the judgment of Willis also, seems to confirm; and in like manner, their laxity, and that of the fornix, and that kind of jelly which lay under the pia mater. Nor is it repugnant thereto, that little water was found within the cranium after death. For it might easily happen, than when the head was severed from the neck, the much greater part of the water might flow out through the tube of the vertebrae: and if it, therefore, was in large quantity, so much the more did it press upon the lax fornix, in proportion as the remaining part of the cerebrum, in consequence of its substance being harder than natural, resisted so much the more the compression of the water. And the fornix would also be the more pressed upon, in proportion as there was less space in the cavity of the ventricles, which naturally, and at other times, if not, as some contend for, without space at all, is certainly, in fact, very small; I say, in proportion to the space in the cavity of the ventricles being diminished, by reason of the greater protuberance, of one of the corpora striata; whether this had been from the original formation, or had grown out afterwards, by reason of those pores being internally added: and you may see an observation in the Sepulchretum, of the ventricles of the cerebrum being "too narrow," in an epileptic patient.

But, if you would rather have it, that no water flowed out from the cranium, and was even in small quantity in the living body; it might also in this way, be the chief cause of that epilepsy, in particular, as it was joined with a propensity to sleep, and with that symptom, which almost constantly follows it, a silliness or idiotism; or that kind of silliness at least, which is for the most part conjoined with it, as we see in persons, who are much inclined to sleep. For although a small quantity of water would press

the fornix less; yet it relaxed still more, that which was already lax, and by this means might render the man drowsy, and heavy. You will ask, for what reason? Doubtless because, as the use of the fornix is not known, nothing forbids us to suspect its use to be of such a kind, that we are under a necessity of being sleepy, when this becomes lax. Perhaps you will believe I am not serious now. However, I joke very safely; for I maintain that there is nobody, who can demonstrate my suspicion to be really a false one. But let us dismiss this subject, since a propensity to sleep, may, perhaps, not only be accounted for, from that defect of blood, which we saw there was in the vessels of the brain; but it is also sufficient here, as sleepiness has been already explained by me, in another place, to shew the only thing, which I undertook to shew, at that time, in the hospital also, that an epilepsy might be excited, either from a small, or from a large quantity of water.

11. For when I had enumerated those marks which are mentioned above, of much water having been previously collected, and had pointed out, for the sake of example, how, according to the dogmas of Bellini, from too great a quantity of moisture, sometimes relaxing, and sometimes contracting, these, or those nerves, an epilepsy, without even supposing any power of stimulus, may be brought on; this other side of the question however, I only just touched upon, being prevented by streightness of time; I mean, that nevertheless, this disorder might also be excited in the young man, at present treated of, especially as a mark of stimulus was not wanting, which I there also mentioned, to wit, a yellowish colour of the water. And indeed among those physicians, who flourished before the more modern ones, our countryman Saxonia, was, in preference to others, of the same opinion. Who, as he deduced the epileptic convulsion from an irritation of the thin membrane, which surrounds the ventricles of the brain, went so far as to say, "that the water, so it be not mixed with a bilious juice, and therefore be not of a yellow colour, or green, does not bring on an epilepsy."

It is true, indeed, that there are frequently found in the heads of epileptic patients "yellow stagnating waters, a yellow and acrid serum, a yellowish lymph, and a citron-coloured serum, which

affects the tongue, after the manner of a salt," as you may understand, even from this section, of the Sepulchretum. But yet Saxonia ought to have known, that Coiterus, who was indeed a most excellent anatomist, "had seen many times in epileptic patients," a water "like" to that, which he had seen in other patients, who had laboured under complaints in the head; that is, "limpid, thin, and pure;" and this "much more often, than that which was yellow, or like in its colour to bile," which you have in the same section: also to set in opposition to what follows, from Saxonia, a little after, in observation the nineteenth, and especially to that ipse dixit of his, which I just now produced; and which you will also read in the scholia subjoined to that observation. From the yellowish colour therefore, when water is impregnated therewith, I conjecture indeed, that a stimulus is therein; but do not confine all the means, by which it may stimulate, to that colour only. For who can doubt, but that the "acrid property, and that which affects the tongue in the manner of a salt," as we mentioned just now, may be latent even in limpid water? You certainly see in the fifteenth observation of this section, "that an epilepsy has sometimes taken its origin from a limpid, warm, and salt humour, almost like the aqua fortis that is used in gilding:" nor in the thirteenth observation does Mangoltius, nor in the sixteenth Hippocrates, speak of the water, which was the cause of the epilepsy, being tinged with any colour; but the latter indeed says, that he found, in an ill-smelling brain, "an eroding and colliquating" pituita, and the former "a salt, subacid, acrid, and somewhat corrosive taste." Therefore when you shall read, that Slevogtius found in a dog, who was epileptic, "a turbid and citron-coloured water" about the ventricles of the brain; or in the Ephemerides Cesareae Academiae, that in two epileptic patients, a boy, and a man, "a large quantity of yellowish serum" had occurred within, or about, the cerebrum, do not more readily suppose, that there might have been a stimulus in these, than where you will learn from the same Ephemerides, that within the brain of a young man, and in like manner of a girl, and an infant, a large quantity of "lymph" had been found, as it was, if not as Gerbezius there thought, "without doubt" at least with

the highest degree of probability, "acid." What if water, by its quantity alone, can irritate? But whether it be much, or whether it be little, so that either by stagnation, or by stimulating particles of any kind, being now and then added, in greater, or in smaller numbers, in proportion to the quantity of water, which then is collected, and in proportion to the sensation of the membranes, which are more or less tense, it become irritating; there is room enough for us to conceive, or I am much deceived indeed, in what manner it may then excite an epilepsy; and in like manner also, how it came about, that when the young man we spoke of, had his urine encreased by diuretics, that then for the first time, the epileptic paroxysm happened; nearly in the same manner, that Poggi had his urine, and at the same time the force of the attacks augmented: for by this encrease of the urinary discharges, the watry humour was drawn off from the body, with which the stimulating corpuscles, whatever, or wheresoever they were, had been diluted; and in proportion as this diluting fluid was decreased, in the constitution, the strength of these attacks seemed to encrease. And, certainly, the cause of so violent a disease is not to be estimated from the bulk of it, but from its power and properties. Thus Fornelius found, "at one time about the meninges, and at another time, in the substance of the brain, a kind of putrid and glutinous sanies, in quantity about the bigness of a bean, which was the fomes of this vehement and cruel disease."

In answer to all these things, however, I am not ignorant that two objections may be made; one, that there are persons, who relying upon observation and experiment, deny, that convulsions arise from an irritation of the membranes of the brain; and the other, that this very water, which we here suppose to be the cause, may, perhaps, be the effect. As to the first objection, I shall have a proper occasion of examining into that, below; and as to the latter, it is by no means necessary, that I go about to discuss it, either because water is not always found in epileptic patients, though convulsions have always preceded, which even that very section of the Sepulchretum teaches; or for other reasons; since I think it is quite sufficient, on this occasion, to retort one thing, which is, that I do not affirm for a certainty, that water is some-

times the cause of an epilepsy, but only suspect, and conjecture: and it is by no means fair or equitable, to suppose, that one suspicion is entirely rooted up, by another suspicion being objected to it. But let us go on to other observations of my own, or those of my friends, in which water was sometimes found, and sometimes not.

12. A man, who exercised the business of a cook, having been before subject to disorders of the urinary passages, was brought into the hospital of St. Mary de Vita, at Bologna, on account of a violent and continual fever, with which he had been seized. I saw the blood that had been taken from him, which was so concremented in the glass vessel, into which it had flowed, that adhering all round to the sides thereof, it had squeezed out all the serum above it, which was in small quantity, and bloody. He continued to grow worse, especially in an evening. About the twelfth day from the beginning of the fever, he died epileptic. As I had not paid much attention to this man's disorder, so neither was I present at the dissection; which was performed by the gentleman who afterwards gave me the narration, Sebastian Anthony Trombelli, at that time a very diligent student, but afterwards a very eminent physician, and surgeon, at Bologna.

The belly had nothing worthy of notice, except the kidneys: one of this, being round, and in some measure resembling a cancer, contained calculi within it; but the other, I suppose, because it supplied the office of both, was almost twice as big as it naturally should be. The thorax, beside an inflamed pleura, exhibited the heart and great vessels turgid with a very black and fluid blood, which was then quite warm, though ten hours after death. Finally, in the head, all the small vessels, whatever, that creep on the surface of the brain, were very red and turgid; and in the ventricles of the cerebrum was a little quantity of water, and that limpid, like lymph.

13. If you do not chuse to lay any thing to the charge of the water here, you may ascribe the epilepsy to the state of all the small vessels of the brain; which being so distended with a blood of this kind, that was also agitated, and comminuted by the fever, distracted the pia mater, in which they are inwoven, and could

not but irritate it. But if the epilepsy does not attack all in whom the vessels are thus turgid, perhaps the cause of the difference is to be sought for, in that membrane's being in a state of less tension. The same section of the Sepulchretum, which we are now upon, certainly shews, that not a few persons have fallen into epileptic paroxysms, from these vessels being distended. For, to pass by the twentieth observation, which is again proposed also under number thirty-three, the second observation in the additamenta, which itself likewise is again repeated, with the same inconsiderateness, under number eleven, exhibits part of the cerebrum "inflamed;" the sixth those vessels "tense and turgid;" and the fifteenth, "very turgid." But you will say, that in all those bodies there was not only a turgescency of the vessels, but also extravasated blood, in the cavity of the cranium. I confess it; but in all these, likewise, there was not only an epilepsy, but moreover an apoplexy, and that a most grievous one, if you attend to it, which succeeded to the epilepsy: so that it is natural to conjecture, that so long as there was only a distension of the vessels, though they were very near upon rupture, by the distraction of the fibres of the pia mater, an epilepsy alone was produced; but when they are already ruptured, and their contents poured out, that then a fatal apoplexy was the consequence. And lest you should happen to think, that this is just said at a venture, read the following very short observation, which my friend Nicolaus Mediavia communicated to me.

14. A porter, about forty years of age, having on those days, that is, about the middle of August, in the year 1729, been exercised with much labour and fatigue, even more than he was accustomed to, and having also overfilled himself with food, but especially with fruits, fell into an epilepsy, which he had never before been troubled with; and being brought into the hospital, he died in a few days. The head, which was the only part dissected, had nothing at all in it worthy of attention, if you except the turgency of the vessels of the cerebrum.

15. If you read over the case of Apellaeus Larissaeus, which you see mentioned in the last scholium to the nineteenth observation of this section, in the fifth book of Epidemics, from whence it is

taken, you will see, that it is so far similar to this just described, that he was carried off by a disorder of that kind, when he had been "very voracious of a great quantity of food and had wrestled, and strained himself much." At the same time you will confess, that to guard against epilepsies, especially of this kind, the blood should neither be agitated by great labours and fatigues, particularly in the summer season, nor be encreased by great quantities of food, especially of the fermenting kind; and that, if by accident it has been encreased, it ought to be diminished by convenient bleedings, according to those happy examples of the physicians, which you will find taken notice of in the scholia to observation the thirty-fifth, and in the third place. From which you may understand, that although the distension of the sanguiferous vessels within the cranium, was not itself, as we conjecture in a certain disposition of the meninges and cerebrum, the very cause of the epilepsy, yet it will not be altogether a useless matter, to know, what can, at least, cherish, and encrease the strength of the cause which gives origin to the disease. And I would have you suppose this to be said in regard to some other appearances, which were seen by me, not only in the cerebrum of epileptic patients, but in others also; as the former letters, compared with this, will shew. For whatsoever I find that is preternatural, in the dissection of any body, I never suppress; but enquire, whether of itself it could be the cause of the foregoing disorder, or only when joined together with others; generally, however, making probable conjectures only, and seldom absolutely deciding upon any thing. Nor does it all escape me, that it is possible, the true cause of the disorder may be altogether imperceptible to our senses; and that not only in these, whose nature, where the brain is concerned, is so particularly abstruse, but even in many other disorders also; and that for this reason, sometimes, no traces of injury whatever were any where found in the brain, by the most inquisitive and penetrating men, after an epilepsy, which had even been idiopathic, as some observations, which are transferred into the Sepulchretum, teach us; although, indeed, there is room to doubt, whether all these observations were taken from patients, who had laboured under an idiopathic epilepsy: and Saltzmann did

very prudently, when he conjectured, in regard to the first of them, that the woman who was said to be epileptic, and had no diseased appearance in the brain, "either had not laboured under an epilepsy, or that the epilepsy had been sympathetic, or from consent." And, indeed, Thomas Bartholin also says, "An epilepsy from the consent of the inferior parts, seldom leaves any traces behind it in the brain." But let us come to those disorders which are manifest, and peculiar to the brain itself.

16. A woman, aged sixty years, who had for almost two years been subject to an epilepsy, was at length received into the hospital, about a month before her death, after having got a blow upon her head, by falling down in one of her fits. At first, no external signs of injury appeared upon the cranium, nor yet any internal symptoms of the brain's being injured. It was afterwards understood, that the blow had been received on the middle of the os bregmatis, on the left side; yet when the bone was there uncovered, no lesion appeared. And in regard to the brain, that was no-way affected, but by the epilepsy, which was a disorder of long standing; and its paroxysms generally recurred after this manner. The patient at first trembled slightly, then lay in a manner rigid, immoveable, and silent, till she came entirely to herself. Then, indeed, she might once have been thought to be delirious; if it had not rather been believed, that she answered less properly to any question, from a kind of stupidity, which was left behind, by the epileptic attack, from which she had just emerged. But last of all, there was an evident delirium; and this was joined with an acute fever, which however was slight, nor attended with any mark of the brain's being affected with any disorder besides this. And even on the three or four last days the pulse being quite sunk, she was perfectly sensible, till at length she died about the middle of December, in the year 1741.

Beside the head, I dissected only the urinary and genital parts. In these nothing appeared which was not natural, except the fund of the uterus, whose internal surface we found entirely of a blood colour, degenerating into blackness; yet in such a manner, that this colour did not penetrate deeply into the substance of the uterus. And that this was not to be imputed to the men-



struous blood, not only the age of the woman was a presumption, but even the pressure of the uterus between the fingers confirmed; for by that means no blood came forth. The cranium being diligently examined, on its internal surface, offered nothing, indeed, that was worthy of remark; although, externally, that part of the bone was red, which I mentioned above. Moreover, although the posterior and external surface of both the sincipital bones appeared to be, in a manner, depressed, yet nothing was seen, internally, corresponding thereto, which was found to be unusual, or preternatural. The meninges were every-where found, so as not even to have any fullness, or distension, in their vessels. But scarcely was the dura mater taken off, when we observed, that in the left hemisphere of the brain, the third and anterior lobe was much lower than its fellow, and much softer; and not only in the upper part, but entirely throughout its substance, the basis as well as the other parts, not excepted. Without doubt, it had sunk thus by reason of that softness; which was very evident in the cortical substance, but much more so still in the medullary. For this last, in particular, was changed into a kind of jelly, in the greatest part of it, which was of a cineritious colour, degenerating into brown, and yet almost transparent. And this disorder had also affected the anterior portion of the lateral ventricle, which was comprehended within that part of this hemisphere pointed out. There was no-where any strong, or disagreeable smell; no-where any pus, or any thing bloody, in this jelly: so that it seemed to be a disorder of a peculiar kind. In the remainder of the cerebrum, and cerebellum, every thing was found; so that scarcely as much water as could be contained in a spoon at once, which was, perhaps, somewhat red from the blood that had been mixed with it, in dissection, was found in the lateral ventricles. Yet a little quantity of water had flowed out, while the cranium was sawed round about.

17. It seemed very surprising to every one, who was present at the dissection, that this woman had lived so long, with so great disorder of the brain, as is described above; whether this disorder had begun before the blow, which her head had received, or its origin was to be dated from thence. The latter of which sup-

positions seems to be argued, from the injury of the brain being situated on the same side, where the blow had been received. Yet if this was the cause of the epilepsy, a disease which had so long before infested the patient, it must necessarily, according to our former supposition, have existed for a long time, before the blow was inflicted. Nor am I without having other examples, of a corruption, or rottenness of this kind, without any previous blow of the brain; one of which you will easily acknowledge, in another woman, if you read over again the fifth letter; although that medullary substance of the cerebrum, which was in a manner colliquated, and inodorous, had something of a bloody mixture, and had brought on an apoplexy, although it took up much less room, than the disorder we at present treat of. But this difference is perhaps to be attributed to the different part which it occupied, to wit, the side of the optic nerve, which ought particularly to be attended to; at least as much as the other example, that I am going to relate, will permit.

18. A man of a low stature, and a slender habit, being seized with a violent return of the epilepsy, which he had been before wont to be afflicted with, was taken off thereby, in a very few days. On diligently examining the principal parts of the body, after death, in April 1722, I observed, that in the abdomen, the right kidney was larger than the left. In the thorax were here and there little beginnings of ossification, in the curvature of the aorta. In the head, besides unequal dilatations, in some parts of one of the vertebral arteries, and that into which it opened, called basiliary, by the celebrated Winslow, there was nothing at all in the other vessels, worthy of our attention, which were neither empty, nor preternaturally distended with blood. Nor was water any where extravasated. But at the extreme part of each thalamus of the optic nerves, the colour degenerating from yellow to black, made a discovery of the disorder, in the medulla which lay under it: and indeed, to as great a depth, as this substance was tinged with that colour descending into it, so far was it softer than it ought to be, and appeared in a manner half-corrupted, to those who looked upon it.

19. Has that "spot" any reference to the present case, con-

cerning which, the passage of Henricus Petraeus is quoted in the *Sepulchretum*? "In the dissection of those, who have died of an epilepsy, no trace of obstruction appears, but sometimes a spot, sometimes a black humour, and frothy, and sometimes nothing at all." Certainly the spot in both the examples produced, was a discovery to me of the disorder that lay near it, which by cutting deeper into it, was of itself fully discovered. But to this peculiar kind of corruption in the brain, this seems to relate, which was observed in that great man Alexander Marchett, who was taken off by a violent apoplexy, after having suffered two attacks of an epilepsy, within the space of a few days. For "the cortical substance of the brain was very tender, so that by a slight touch it was converted into a fluid substance, as if it had never cohered." And that corruption, also, has an affinity with this, except its being much deeper, which Ernest Gottlo Schmidti<sup>us</sup> saw in a soldier, after very grievous pains, and other disorders of the head, that were the consequence of a blow thereon, and, in like manner, that which Carlo Curti observed in a young woman, after an apoplexy. For the first not only found a transmutation of the whole right hemisphere of the brain, so that its substance "was like a kind of pretty fluid jelly, or rather a colliquated matter, which flowed abroad with the least touch," but the same transmutation also "had in like manner proceeded in various places" to the left hemisphere. And the other found the whole right hemisphere, and its meninges, changed into a mucous substance; so that following the point of the knife, which raised it up, it was drawn out, after the manner of a thread. But the anterior extremity of each hemisphere, in a man whom the celebrated Kaavius dissected, had passed into a more evident abscess, or at least not a disorder of this kind, though the man, and his history, were both unknown, as he was found dead in the public way. For the cortical part of the brain "was converted into a foetid, yellow mucus, so that the vessels of the pia mater floated loosely therein." Here you see the disorder had a foetid smell attending it, which is spoken of in no other of the observations, that have been produced, and even in one, is expressly denied, and was certainly wanting in the four made by me; the

last of which I took from an old woman who died of an apoplexy, and shall send the account of to you, on another occasion. But, to return to the woman who had the contusion on her head; whether the disorder, which we found in her brain, had its origin, as in the three others dissected by me, and, in like manner, as in Marchetti, and the woman that Curti mentions; or whether it was rather the consequence of that blow, as in the soldier whom the celebrated Schmidtus speaks of; I leave entirely to your judgment to determine, and even still more in one, and another, of whom I shall now give you an account.

20. A man being stricken on the head, by a log of wood falling upon him, was thereupon seized with an epileptic disorder, to which it was said he had been before liable; however, he was certainly attacked with them much more often, in the few months which he lived afterwards, and still more often in the last week of his life. He was besides, shaken with so great a tremor, that they were obliged to confine him with bands, lest he should fall out of bed. An amaurosis also had come on; for he now discerned nothing, although no disorder appeared in the eye, beside a dilatation of the pupil. But as to the other actions, which are called animal actions, he neither complained himself, nor did he seem to others to be injured, unless that he was not quite so ready as usual, in answering, when a question was asked him. Being thus affected, he died away by degrees. The head came to me to be dissected, when I was teaching anatomy in the college, in the month of February, 1728. The upper part of the cranium, if you except some places, in which it was naturally thick, protuberated inwards, and was every where so thin, that it was hardly credible. And even in one place, which belonged to the right bone of the sinciput, it had a foramen almost of an elliptical figure. A little less than to admit the point of a little finger, shut up with a membrane, without the least sign of caries round about the edges thereof, or any where in the whole cranium. Nevertheless, to this foramen, which was shut up as I have described, a little foramen, in the dura mater beneath it, corresponded, from which a serum of a brown colour issued out. This small foramen communicated with a cavity, big enough to re-

ceive the bulk of a large egg, full of the same kind of brown serum, in which a small quantity of coagulated blood had subsided. This cavity was of an irregular form, and had an unequal surface internally; and the parts of the brain, which were nearest to it, round about, had lost their natural colour, and were tinged of a dirty brown, which was an indication of the substance being half-corrupted: but more especially, that part of the basis of the cerebrum, which is placed upon the posterior region of the right orbit, and also the anterior part of the right corpus striatum, which lay above that. And even the thalamus nervi optici, on the same side, although it was pretty remote from the cavity, yet seemed to be shrunk and wasted. Yet both of the optic nerves, when inspected on the inside, and on the outside, of the cranium, as also the several parts of both eyes, though diligently dissected by me, shewed no fault, or disorder, any where, that could fall under the notice of the senses, whether I considered the colour, the magnitude, the firmness, or the structure thereof. But although the left hemisphere had none of those appearances, which were remarked in the right; yet in the left lateral ventricle was much pellucid water, and the plexus choroides were pale, and colourless, with a few small vesicles upon them: the whole cerebrum also was of a dirty yellowish colour, and its vessels were very turgid with black blood. Finally, the pituitary gland was very much depressed, and small, but not hard.

21. Concerning the amaurosis, which had fallen on each eye, although the brain was only injured on one side; this is not the proper occasion of examination into it; nor yet in regard to those continual tremors, or, if you chuse rather to call them so, convulsive motions. But in regard to the abscess exciting the epilepsy, or at least much more frequently than usual in the same man, I would have you compare therewith, the dissection of Alexander Marchetti, above pointed out; for in his brain, beside what I have there taken notice of, there was also an abscess not very dissimilar to this. You have besides, in the Sepulchretum, the observations of Fernelius and Smetius; the former of which, though you will see them repeated in another place, I had rather you would read in the first place they are spoken of, where he

says, in regard to the epilepsy which has its origin from the brain, "that he had sometimes found the cause, to be an abscess of the cerebrum: and sometimes a corrupted portion of the meninges adhering to the skull." For in the history given by me, you have both causes to recur to, that is, the abscess of the cerebrum, and a corruption of both the meninges, though but small, brought on from the most filthy humour, which had corroded and perforated them. But Willis, you will say, did not admit of this second cause; inasmuch as he, as you will also read in the *Sepulchretum*, neither from an abscess formed in the dura mater, nor from the most foetid pus, discharged from thence, and corroding the pia mater also, nor even from a great laceration, by the trepan of an unskilful surgeon, did ever see any disorder of an epileptic kind brought on. And I, besides these things, am by no means ignorant of the experiment of Ridley, that he made upon a dog, which, after a perforation of the dura mater, "was free from convulsion of every kind." None of all these things would I dare to deny. I will rather seek the reason of the difference between these, and the contrary observations, and contrary experiments of other persons. And to contract my discourse upon many things, into a few words; you have doubtless read in the history of the Royal Academy of Sciences at Paris, that in a young man who had laboured under an epilepsy of long standing, and which, in process of time, had increased in the number and violence of its accessions; the cause thereof was found to be, some exceedingly small bones which had their bases in the dura mater, and their very acute apices, or points, so turned against the pia mater, that they could not but prick and irritate it, and so much the more, the more they increased. You have also seen, to pass over other experiments of the Italians at present; you have, I say, seen in the commentaries of the academy of Sciences at Bologna, that when the celebrated Peter Paul Molinelli "often pricked the dura mater, which was partly laid bare, in a living dog," he observed that the dog was distorted, with various convulsions, "especially when that part of the dura mater was "pricked, which adhered the most closely to the bone."

Shall we therefore account for the apparent difference from

this latter part of the experiment, and conjecture that which reason itself seems also to confirm, that unless the meninges are equally tense, equal effects are not to be expected from their irritation? And this greater tenderness may be brought about, not only by an adhesion to the bone, but by other circumstances also; as for instance, by a distension of the vessels in both of the membranes, and by too great a hardness of the cerebrum in the pia mater, that immediately invests it. Which two appearances, you will remember, were remarked by me, in some bodies, that I spoke of above, and particularly in this which I speak of at present; and if not conjointly, at least separately. For thus you will more readily admit the conjectures, which I advanced in respect of these patients, concerning the irritation of the membranes of the brain. And after the same manner also, you will be able to understand that which is related in another part of the history of the Royal Academy already commended, of the sharp points, or prickles of little bones, sticking out from one side of the upper parts of the sinus of the falx, and exciting epileptic paroxysms, without any alleviation, except from large evacuations of blood. On the other hand, in the dog spoken of by Ridley, "a hemorrhage" had preceded the perforation of the dura mater, which, if it had been slight, would not have been mentioned by the author of the experiment. And from this cause, with so much the more ease, a laxity might happen, as that part of the dura mater which was perforated, no more adhered to the bone. And nothing forbids us to suspect, that in one or two observations of erosion, or perforation, of the dura and pia mater, industriously, perhaps, selected by Willis, from a great number, to suit his present purpose and opinion, there were at least some causes of laxity, if not of the same kind as these: which laxity, if it had existed in the young man, and in like manner in that general, one of whom you read of in the fourth observation in this section of the Sepulchretum, and the other in the twenty-seventh observation, and more at large in the first section, observation sixty-nine, though erroneously marked by the printer forty-nine, I believe the dura mater "being eroded" with pustules, would not have brought an epilepsy on the former; nor in the latter "a pretty large bone, that

was sharp like a star stone, would," with so much ease, "have given occasion, by the point thereof, to the inflammation, and corruption of the dura mater, joined with an epilepsy."

22. But that sharp bone found "in the middle of the brain," as it hurt the dura mater by its point, makes me conjecture that it was placed betwixt the two hemispheres; so that it belonged to the falx, and the neighbouring parts of the meninges, and not to the substance of the brain; especially as the author of the observation, in order to remove all suspicion of the bone having, perhaps, fallen down, from the nearest part of the cranium, which might formerly have been broken, into that place, has by no means said what he ought not have omitted to inculcate, that there had never been any previous, violent, and constant symptoms of that substance being wounded; but has only added, "that no mark of the cranium having been formerly broken, or of a remaining cicatrix, was observed." Which words put me in mind of obviating your doubt. For you may, perhaps, enquire, whether I think, that, in the man of whom we now treat, the foramen, which was observed in the skull, is to be attributed to the bone being taken away, by the surgeon, after a blow, or to the bone being formerly eroded? But I cannot admit, on this occasion, either one cause or the other, since I know that no mention was made of surgery having been applied to, in consequence of the blow; and I saw no trace of a cicatrix, either above, or below the foramen, nor the least mark of the bone having ever been affected with a caries; so that I have sometimes rather been tempted to think, much in the same manner as Lancisi did, in relation to a foramen almost similar to this, found in the same bone of an apoplectic man; I mean, that the bone had been imperfect from its original formation, nor that this part of the bone had been filled up; especially, as the general thinness of the cranium proved an original deficiency of bony matter. Nevertheless, when, on the other hand, I call to mind the abscess described in the brain, and the cavity of it, which was subjected to that foramen, and in the same place, the two meninges pierced through with a small foramen, which communicated with the cavity, I confess, that I am not a little in doubt upon the de-



cision. Wherefore, I will rather add, in this place, the observation of Nicolaus Mediavia, which you may compare with this; for in that an abscess of the cerebrum, and an epilepsy were, at the same time, joined with certain erosions of the cranium.

23. A woman had two venereal tumours, in the upper part of her forehead, of the same kind with those that are called "gum-mata." Mercury being given to her on that account, a salivation was excited. In consequence of which, the left tumour subsided, but the right remained. And where the tumour had subsided, a pulsating protuberance appeared. It was certain, that the woman, before the use of mercury, had been subject to an epilepsy: and once indeed in the middle of the cure, and again, when this was completed, she was agitated with convulsions, attended with a foam flowing out of her mouth. At length, without having any part of her body affected with a paralysis, but lying for some days, in a kind of sleep, as it were, so that she seldom spoke, she died, about the middle of October, in the year 1739.

Upon diligently examining the cranium, and cerebrum, it was found that the prominence, which I mentioned above, was covered over with a kind of membrane, not thinner than that thickest sort of paper which is commonly called pasteboard, but flaccid; so that being rubbed together, betwixt the fingers, it was easily broken asunder. This membrane occupied the place of both meninges in that part; for the cortical substance of the cerebrum was immediately under it, which was from thence, quite to the medullary, much harder than it ought to have been, that is, not less hard, than the substance of the liver. But the remainder of the left hemisphere, except the posterior part, was, on the contrary, much more soft than it naturally should be. And within it was a cavity, of the bigness of a small wallnut, contained within very soft and livid parietes of the medullary substance; from which, having an aperture at the upper part, a humour, at first blackish, then of the colour and consistence of serum, in which a kind of filament swam, flowed out; not having any ill smell whatever. This cavity lay over the anterior part of the lateral

ventricle, with which, however, it did not in the least communicate; nor yet with that prominence which is described; and was even distant from it about two fingers breadth. But in the cranium was a foramen of an elliptic form, corresponding to this prominence, having its borders every where equal and regular, as if they had been smoothed down with a file. These were the appearances on the left side. And on the right was nothing worthy of remark in the cerebrum. As to what belongs to the brain; the tumour on the right, which had not subsided, had not yet penetrated, by its corrosion, to the internal surface of the bone. But in the other place, where the bone was entirely wanting, a kind of thick membrane lay beneath: was it because the other tumour, upon taking of mercury, had fallen away from thence before?

24. If you compare this dissection with those few, in this section of the Sepulchretum, *De epilepsia*, which we are now upon, that relates to the venereal caries of the cranium, and gummata; you will, perhaps, set the greater value upon it, because it shews what has been the consequence of gummata in the cranium, and the cerebrum, that was situated near them. But you will not, I suppose, imagine, that the abscess belonged altogether to the gummata; as, on the other hand, you will, no doubt, judge that the hardness, which was left in the cortical portion of the cerebrum, lying under the gumma, had a reference thereto. And yet it is certain, that both the one and the other are sometimes met with in epileptic persons. But as to the abscess, since this is evident, even from many observations in the same section; I will pass over that, to point out some upon the hardness of the brain. Wherefore omitting those, which refer to the firmness of the whole cerebrum being greater than natural, one of which kind is in the same section, another in the History of the Royal Academy of Sciences at Paris, and a third above described by me; you will remember that Anthony Pacchioni has remarked the hardness of a certain part; for in an epileptic cardinal he found the cortical part of the cerebrum, where it answered to a large hydatid, "grown to such a consistence as to resist pressure, and

to seem entirely schirrhous;" and that the celebrated John Fantonus, in the head of a boy, who had been carried off by an epilepsy, had found "a portion of the corpus callosum of the cerebrum, very hard, and no other "morbid appearance." Add to these gentlemen, the celebrated Abr. Kaavius, and Balthasar Walthieri. For the first in a marine soldier, who had long been subject to epileptic attacks, and in the last of these, which was by far the most violent, had suddenly died, observed, among other things, that the cortical substance of the brain was not only every where "much indurated, but in many places schirrhous, and in others, in a manner, cartilagineous, especially the nearer it was to the vertex." And Walthieri, together with other observations which I have before mentioned, sent also this to me, the substance of which I will immediately commit to writing.

25. A man aged thirty-five years, of a slender habit, being seized with a pain in the head towards the forehead, joined with a sense of weight, and having tried a great number of remedies in vain, which for the space of two years before had been prescribed him by the most celebrated physicians, fell into a flux of blood from the nostrils, which, after having been discharged in great quantity, ceased of itself to flow any longer. After this he was deprived of the faculty of smelling, and then seized with epileptic insults; and with these he was very often afflicted for two years, till at last he died. The skull being opened, nothing was found preternatural, except at the anterior parts of the cerebrum, where, on the left side indeed, some little quantity of blood was extravasated, but on the right, towards that process, which anatomists call the crista galli, the cerebrum itself was hard, and callous, and was found to be very closely connected with the dura mater.

26. It is probable, that the animal spirits are put out of their course, and reflected into tumultuary motions, as often as being more swiftly agitated, from any cause whatever, they come to some certain places of the brain, which by reason of a callous hardness, or an interposed abscess, are altogether impervious: although, indeed, it seems, that even the abscess alone may, by

emitting something from itself into the neighbouring parts, excite tumults in the brain. However this may be, if from the hardness of the cerebrum, or from abscess, or an impostume sui generis, or from a distension of the vessels, or from water in large quantity, or small, yellow or limpid, or if from any other causes whatever an epilepsy may have its origin; or whether you choose rather to consider any of these circumstances as effects, rather than causes; but do not deny that the disorder may be preserved, cherished, and encreased thereby; you certainly see, upon any of these suppositions, how difficult the cure of it sometimes will happen to be, and so far even as to exceed all the force and power of art. You also see, when the epilepsy is not beyond the reach of art, how various the method of cure ought to be; and that not only when the cause is without the cranium; of which species, together with its various treatment, I have given you some examples above; but also when it is within the cranium. And for this reason physicians are sometimes deservedly, and sometimes undeservedly, accused; but deservedly, in particular, with great reason, those who attempt the cure of every epilepsy, indiscriminately, in one method and manner. But this necessity of a various and manifold method of cure, which is abundantly evident from other disorders also, causes the greatest difficulty in the art of healing properly: and as anatomists are always demonstrating this more and more, by discovering the various causes of one and the same disorder; so I would to God, that physicians, by more accurately observing the various signs of these various causes, might equally still more and more extenuate and lessen this difficulty; and this indeed is by no means to be altogether despaired of, so that both the anatomists, and physicians, shall unanimously concur, as is their duty to do, the first by accurate dissections, and the last by diligent observations, every one to act his part well, in an affair of such great moment. Both of which, or at least one or other, I beseech you to undertake; nay rather see to it that you do, if you find that I do not desert my posts. Farewel.

## BOOK THE SECOND.

## OF DISEASES OF THE THORAX

## LETTER THE TWENTY-SIXTH

TREATS OF SUDDEN DEATH, FROM A DISORDER OF THE SANGUIFEROUS VESSELS, ESPECIALLY THOSE THAT LIE IN THE THORAX

1. Although sudden deaths seem to be grown more frequent than usual in this age, yet that they have not been uncommon, now and then, at various times, in Italy, and in other countries, in preceding ages, I have demonstrated to you in a former letter. This will be confirmed to omit Pliny, who has written that they were "frequent;" and although he mentioned many himself, has even informed us, "that Verrius had produced a greater number of instances;" this, I say, will be confirmed by the more recent examples of the eleventh section of the Sepulchretum, which is entitled, *De Morte Repentina*; there, in particular, where you will either find Bartholin asserting, that in the year 1652, "in the beginning of the month of February, by reason of the uncertain temperature of the air, many were suddenly taken off in the city of Copenhagen, by an unexpected death;" or where Panarolus informs us "that in the year 1651, a great number was taken off by a sudden and instantaneous death, in a short space of time," at Rome. To these add Lancisi, who shows that the same thing had happened under Alexander the seventh; that is, a few years after, in the same place, and in Tuscany about the same time, as I suppose, but before, that is, about the beginning of the last age, both at Rome and at Venice, and in other cities also.

2. But whensoever, and wheresoever, deaths of this kind have happened, I do not doubt but the cause is to be enquired after by anatomists, either in the brain and nerves, or in the lungs and aspera arteria, or, finally, in the heart and sanguiferous vessels; and Lancisi has before sufficiently demonstrated the same thing, in the excellent books which he published, *De Subitaneis Mortibus*. Since, therefore, that cause has been already enquired after by me, in the two first of those different seats, when I wrote to you the letters upon apoplexy and upon suffocation; it will remain

at present to enquire after it in the third seat, that is, in the heart and sanguiferous vessels, and particularly in those that are contained in the thorax. For I am not willing to do what I see is frequently done in this section of the Sepulchretum, I mean, to repeat what I have before said of apoplectic or suffocated persons; nor yet to speak of those who have died suddenly from a peculiar injury of any of the abdominal viscera, before I begin to treat of the diseases of the belly: although the proximate cause of this kind of death is not in that diseased viscus, but by means of the nerves, or the sanguiferous vessels, is generally in the brain and the heart. That is to say, in this viscus of the belly, either the nerves are so irritated as to convulse the muscular part of the heart; or the meninges of the brain, or the vessels are so eroded, that the blood being extravasated, a proper quantity thereof is suddenly deficient in the heart and the brain. But these things we shall consider in their proper places.

I will now tell you what causes of sudden death have offered themselves to Valsalva, and to me, in the heart and the neighbouring vessels. And under the term of sudden death, I here understand that which, whether there is any previous apprehension of it or not, snatches a person away suddenly, contrary to his own expectation, or the expectation of others, at that time. Examples of which kind of death, from the disorder either of the heart, or the vessels that lie near it, I have had occasion to give in letter the seventeenth, the eighteenth, the twenty-first, the twenty-fourth, and the twenty-fifth. But now take the greater part of those which remain: and first, these three from Valsalva, that relate to the vessels; for those that refer to the heart, we shall refer to the next letter.

3. A man of fifty years of age, who had been used to spit blood at times, though in small quantity, and sometimes also to breathe short, having laid hold of a hammer with both his hands, and stricken something or other with a great force, and for a long time together, fell down suddenly, and with one or two words called out for help. Soon after, having lost his speech, and breathing with great difficulty, and having his face very pale, he died within half an hour.

The left cavity of the thorax was found quite full of blood, the greater part of which had coagulated. This blood had burst forth from the great artery that was eroded at the part where, being about to descend to the vertebrae, it is infected. For in that place, being dilated into an aneurism, it had hollowed out the corresponding vertebrae; and where these were hollowed out, there the artery seemed to be consumed.

4. How much they ought to avoid any exertion of their strength, in whom there is a dilatation of an artery, even the present case shows. For an exertion of strength is followed by an increased impetus of the blood, by which the coats of the arteries being extended, or in part eroded, are broken through. And although this happens to many of them spontaneously, as it did to that young man of whom I am next to give you the history, yet to many also it does not happen: and it becomes every body to beware, lest they themselves accelerate that death which otherwise would have come more slowly.

5. A young man, of about twenty-seven years of age, had been afflicted, already, for a long time with a pulsating kind of tumour in the right part of the thorax, betwixt the third and the fourth rib; in which tumour, while he turned himself from one side to the other, he felt a fluctuating matter that was acted upon by that motion: in the mean while, he had been often seized with a shortness of breath; which, however, in a short time after a vein was opened, remitted. One day, as he was at his devotions, he fell down suddenly; his face was pale, he could scarcely speak; he soon died.

In the thorax was seen a large aneurism. For where the carotid arteries came off from the aorta, it began; and extending itself to the sternum, to which it then strongly adhered, so that it could not be separated without laceration; it was also produced under the right clavicle to the third and fourth rib, the internal surface of which it had hollowed out, and had rendered rough and unequal. Finally, it came within the pericardium; where, being ruptured, it had filled all the cavity of it with blood. There was no polypous concretion in the heart.

6. But the great artery is sometimes eroded, even without an

aneurism, and pours out its blood, as the next very short history teaches.

7. A certain man was taken off by a sudden death, in the latter end of June, in the year 1689. Permission being obtained, with great difficulty, from the relations to dissect the body, the aorta was found to be ruptured where it was nearest to the heart; and the pericardium was from thence quite full of coagulated blood.

8. Do not be surprized that I make little or no remarks to these observations. For where I wrote upon the subject of aneurisms, I interspersed a sufficient number of remarks that are suitable to the present occasion; and these observations are, in general, pretty clear of themselves; and besides these, I have a considerable number, which are not very short neither, to subjoin. And that they may correspond, as far as possible, to the observations of Valsalva, already proposed, I will begin with aneurisms of the aorta.

9. A man who had been too much given to the exercise of tennis and the abuse of wine, was, in consequence of both these irregularities, seized with a pain of the right arm, and soon after of the left, joined with a fever. After these there appeared a tumour on the upper part of the sternum, like a large boil: by which appearance some vulgar surgeons being deceived, and either not having at all observed, or having neglected, the pulsation, applied such things as are generally used to bring these tumours to suppuration; and these applications were of the most violent kind. As the tumour still encreased, others applied emollient medicines, from which it seemed to them to be diminished; that is, from the fibres being rubbed with ointments and relaxed; whereas they had been before greatly irritated by the applications. But as this circumstance related rather to the common integuments, than to the tumour itself, or to the coats that were proper thereto, it not only soon recovered its former magnitude, but even was, plainly, seen to encrease every day. Wherefore, when the patient came into the Hospital of Incurables, at Bologna, which was, I suppose, in the year 1704, it was equal in size to a quince; and what was much worse, it began to exsude blood in one place; so that the man himself was very near having



broken through the skin (this being reduced to the utmost thinness in that part, and he being quite ignorant of the danger which was at hand) when he began to pull off the bandages, for the sake of showing his disorder. But this circumstance being observed, he was prevented going on, and ordered to keep himself still, and to think seriously and piously of his departure from this mortal life, which was very near at hand, and inevitable. And this really happened on the day following, from the vast profusion of blood that had been foretold, though not so soon expected by the patient. Nevertheless, he had the presence of mind, immediately as he felt the blood gushing forth, not only to commend himself to God, but to take up with his own hands a bason that lay at his bed-side; and, as if he had been receiving the blood of another person, put it beneath the gaping tumour, while the attendants immediately ran to him as fast as possible, in whose arms he soon after expired.

In examining the body before I dissected it, I saw that there was no longer any tumour, inasmuch as it had subsided after the blood, by which it had been raised up externally, had been discharged. The skin was there broken through, and the parts that lie beneath it with an aperture, which admitted two fingers at once. The *membrana adiposa* of the thorax discharged a water during the time of dissection, with which some vessels were also turgid, that were prominent, here and there, upon the surface of the skin in the feet and the legs. In both the cavities of the thorax, also, was a great quantity of water, of a yellowish colour. And there was a large aneurism, into which the anterior part of the curvature of the aorta itself being expanded, had partly consumed the upper part of the sternum, the extremities of the clavicles which lie upon it and the neighbouring ribs, and partly had made them diseased, by bringing on a caries. And where the bones had been consumed or affected with the caries, there not the least traces of the coats of the artery remained: to which, in other places, a thick substance every where adhered internally, resembling a dry and lurid kind of flesh, distinguished with some whitish points; and this substance you might easily divide into many membranes, as it were, one lying upon another, quite dif-

ferent in their nature from those coats to which they adhered, as they were evidently polypous. And these things being accurately attended to, nothing occurred besides that was worthy of remark.

10. The deplorable exit of this man teaches, in the first place, how much care ought to be taken in the beginning, that an internal aneurism may obtain no increase: and in the second place, if, either by the ignorance of the persons who attempt their cure, or the disobedience of the patient, or only by the force of the disorder itself, they do at length encrease, so that they are only covered by the common integuments of the whole body; that then we ought to take care lest the bandages, especially when they are already dried to the part, be hastily taken off: and finally, if the case proceed to such an extremity, that the rupture of the skin is every day impending, and bleeding, either on account of the constitution or infirmity of the patient, or on the score of other things which I have hinted at already, is dangerous; that every thing is to be previously studied, by which, for some days at least, life may be prolonged. That is to say, besides the greatest tranquility of body and of mind, and the greatest abstinence that can be consistently observed, so that no more food be taken than is barely necessary for the preservation of life, and that in small quantities, and of such a quality as is by no means stimulating; besides that situation of body, by which the weight of the blood being lessened, does not press upon the skin, and other things of the like kind; something ought to be thought of by the surgeon, by way of defence; as, for instance, if the bladder of an ox, four times doubled, were applied, or a bandage of soft leather; and the edges of this bandage were all daubed over with a medicine, by which they would be firmly glued down to the neighbouring skin that lay around the tumour, and was as yet sound and entire. But you will judge better of these things; for as to me, carried away with a desire of preserving a man's life, though but for one short hour, I perhaps talk foolishly. As to streight bandages, and plates of elastic steel or the like, I say nothing of them; not so much on account of those things which Lancisi has observed, of the most considerable injuries being brought on by

them in process of time; for the question is not at present how the patient may live the longest time he possibly can, but only how to prevent his dying immediately; as on account of the skin being extenuated, in which case all pressure is dangerous. However, in regard to the three patients who may be compared with this that we have described, and who were dissected by Wagnerus, by Lafagius, and Lentilius, you may see what was applied in the last, in order to retard the torrent of blood; although in the second only, nothing now remained but the attenuated skin to be broken through by the impetus of the blood; for which reason the event was the same in him as in this man of mine; so that as soon as the tumour began to be ruptured, at the same time a vast haemorrhage and death were brought on.

As to what remains, this example of mine, of a very speedy death, from the bursting of an aneurism externally; although I confess that it does not so immediately belong to our present design, because that cannot be called sudden, which was evidently known to be at hand, and foretold; I nevertheless produced here, in order to lay before your eyes a kind of picture, as it were, of the internal rupture of an aneurism. For when the coats of the artery are extenuated, just as we have seen in the skin, it must of course happen that an aperture is made, and that the blood is poured out in the same manner that I have described to you formerly, in a woman, from my own observation; and as I shall describe to you now, in a man, from an observation, which being taken in the latter end of November, in the year 1708, by the very accurate Sanctörini, he communicated to me the day following, when he was returning to Venice together with me.

11. A robust young man, who had been used to live on board of the galleys, being subject to a disorder which persons among the Venetians, who are not acquainted with physical matters, call *flato*; supposing it to be from wind, notwithstanding it is frequently joined with some internal and organic disorder; was seized with a difficulty of breathing after any violent motion. Two other things were also observed by his companions; the one, that he was accustomed to become immoderately sleepy after food; and the other, that he used frequently to apply both of his hands

to his loins, and rub them strongly downwards, as if he felt some uneasiness in that place, which was alleviated by these frictions. This man died suddenly, as he was sitting by the fire-side, in a house of ill fame. His body being examined, of which neither the legs nor the belly appeared swelled, and this cavity being opened, the diaphragm was found to be depressed. The right cavity of the thorax contained a great quantity of extravasated blood. This had issued forth from the great artery; which being now very near to the diaphragm, had there dilated its own trunk into an aneurism of the bigness of a fist. And this aneurism, being filled with polypous and with membranous concretions, as it were, was ruptured quite through on the right side; and on the left side had so injured the bodies of the neighbouring vertebrae, that a large bony scale was drawn off from them without the least difficulty. However, there was no ossification in the aorta. The heart was very hard, and contracted into itself.

12. That the heart may be convulsed, is already said in the former letter. An example of which kind you have, unless I am deceived, in this young man, but to be attributed to another cause. However, that after food he became more sleepy than others, seems to be owing to the aneurism, and to the distension of the stomach; which although at that time it turn its fundus forwards, yet in proportion as it occupies more space itself, so much the less, howmuchsoever, the abdomen may yield, it leaves to the other viscera of the belly; so that sanguiferous vessels being there compressed, the blood is carried to the brain, to which the passage is more free and easy. If, therefore, from this cause others become more prone to sleep, this young man was so much the more prone thereto, from the same cause, as by reason of the aneurism being situated in that place, the course of the blood downwards was still more obstructed. The other circumstances of this history it is easy to explain; and among these, the rupture of the aneurism being brought on, particularly, in that house, where, perhaps, he did not sit by the fire when it happened. Without doubt, many things are very often forged by the women and the friends of the patient, for the sake of making the affair seem more decent. See what Lancisi has suspected, in regard to

the sudden death of another young man, in a similar place. He was also said to have come "near the fire, for the sake of warming himself." What if it was that fire of which Parmeno, in Terence, if I rightly remember, says,

*Accede ad ignem hunc; jam calesces plus satis.*

Come near to this fire, and you will be abundantly warmed. But the Deity, nevertheless, who is the avenger of sin, does not always suffer it to be concealed, how he punishes in the crime, by the crime itself. Which might be easily understood in the case of that soldier, whose "sudden death happening in" *aestu venereo*, "with a horrible clamour and tossing of the body," is related by the celebrated man Christian Vater; and that from an eruption of blood into the pericardium, without doubt from some pretty large vein, if there really was no "rupture of the heart, or auricle." But it is still more clear in that dreadful case, which the following history will inform you of.

13. A strumpet of eight-and-twenty years of age, of a lean habit, having complained for some months, and particularly for the last fifteen days, of a certain lassitude, and a loathing of food, and almost of every thing, for this reason made less use of other ailments, and more of unmixed wine; to the use of which she had been always too much addicted. A certain debauchee having gone into the house to her, and after a little time having come out, with a confused and disturbed countenance, and she not having appeared for two or three hours after, the neighbours, who had observed these things, entering in, found her not only dead but cold; lying in bed with such a posture of body, that it could not be doubted what business she had been about when she died, especially as the semen virile was seen to have flowed down from the organs of generation. I was, therefore, asked, whether I desired to have the genitals or not? and whether I would have the other viscera also? I answered, that I should be glad of both; not that I expected to see any thing particular in the organs of generation, now that the semen had flowed out, but that I wished to take fresh notice of some things which I had often observed; for I conjectured, as I then said, that the cause of this sudden death would certainly be found to consist in the rupture of

some large vessel. It was at this time extremely hot, it being June of the year 1725; nor were we allowed to dissect the body till about the latter end of the following day. For which reason, changing my design, I sent my friend Mediavia to examine all the parts; and to take care to bring home the principal of them only to me.

The neck was livid under the chin, yet without any marks of force having been externally applied. The back was also somewhat livid. The abdomen was tense, and did not shew any mark of the woman's having ever been pregnant. The uterus being taken away, the small intestines appeared very red. The large intestines, and especially the lower ones, were full of excrements: the stomach was very large, although almost empty. There was serum extravasated in the belly, to about the quantity of a pint, not unlike turbid water in which fresh meat had been washed; and so acrid, that it affected the extremities of the fingers with the sense of a kind of heat. In the thorax, the lungs were so far of their natural colour, that they were not black even on the posterior part. But the pericardium was so distended, that no sooner was a little wound made into it, but a serum burst forth, of the same nature with that which had been seen in the belly. Yet still a great quantity remained, and under it a black and firmly-concreted blood covered the surface of the heart. Which being brought to me on the following day, in the morning, together with the large vessels and the genitals, I observed, before I cut into them, that neither the heart itself, nor the trunk of the great artery, was dilated; and even that both of them, by their smallness, corresponded very well with the stature of the woman, which they said had been rather small. Being then about to lay open that artery from the inferior extremity, which was at the septum transversum, and having seen that one side of it, not much higher, was black to the extent of five or six fingers breadth; I found that this was owing merely to the effusion of blood into the cells of the external coat; for the other parts were quite in their natural state. But an internal disease began from the left extremity of the curvature of the aorta, and going from thence quite to the heart, became so much the larger in proportion as the

artery came nearer to the heart. That is to say, in some places whitish marks of a future ossification occurred; in others, some small foramina, as it were, had begun to be formed; and in still other places were parallel furrows, drawn longitudinally: and in this manner was the surface of the artery unequal here and there. But when I came near to the similunar valves, which seemed to be lank and contracted, at the distance of half an inch above that which lies on the back-part, was an orifice that would have admitted the end of a man's thumb, by means of which the aorta communicated with a roundish aneurism, that hung to it in the form of a sacculus. This sacculus exceeded the size of a walnut before it is stripped of its green coat; and was so placed at the back of the aorta, that, as it inclined a little to the left side, it seemed that it could not happen otherwise, but it must have obstructed the offices of the left auricle, or the adjoining sinus. And it had been ruptured in the upper part by the blood flowing from thence into the pericardium through a small foramen, the edges of which were lacerated and black. The internal surface of the sacculus was invested with red and polypous pellicles, which, like the texture of an onion, you might divide into as many strata or lamina as you pleased. But in the auricles and the ventricles of the heart, neither was there any polypous concretion, nor did the least quantity of blood remain.

Having found these appearances, I turned my eyes and knife to the uterus, the ovaria, and the tubes. One of the tubes had the extremity of it grown into one substance with one of the extremities of the ovarium. And the extremities of both tubes where quite shut up; so that no orifice, nor fimbriae, any where appeared. But as both the tubes were somewhat wider than usual to that part, they shewed, when cut into, even somewhat more than usual of that humour which belongs to it, and which has been by some taken for the semen virile; but this issued forth in a very thick state, and in the end was somewhat bloody. That ovarium, to which I said that the tube was attached so as to form one substance with it, contained a great number of vesicles, and those of a pretty large size. And although both of them were somewhat round, smooth, juicy, and turgid; one of them

was, however, rather enlarged, because, besides vesicles of that kind, it had, on one side, under the very membrane of it, a black and almost coagulated blood, the quantity of which was, in proportion to the bulk of the ovarium, not inconsiderable.

Finally, in the uterus was nothing worth of observation, except that the interior surface of it only was of a brown colour, mixed with red, and that universally, even to the internal borders of the os uteri. This aperture was narrow; but disfigured with a kind of white and thickish humour, which, as it was not only unlike the semen virile, but also unlike that mucus which is generally found there in the natural state of the parts, gave us a suspicion of some kind of fluor under which this woman had laboured.

14. They who contend that the male semen reaches quite to the tubes of the woman, carried away by a similitude which has not only imposed on "good physicians," as Hippocrates says, but also sometimes imposes upon anatomists; would suppose, on this occasion, that the whole of the semen had not flowed out of the pudendum of this woman. For me, however, whose intention it is not by any means to call into question what the greatest anatomists testify that they have sometimes seen, but what some others determine to be the more frequent and the more certain; it is sufficient to have related what I had myself observed. But although Donatus has collected many examples of those who died suddenly in the act of venery, yet he has not taken notice of all that he had it in his power to take notice of; since Pliny alone, in that very place which he quotes, has not produced two only, but four.

Yet amongst these he has produced no example of a woman, if you except those who had been killed by debauching with an unsufferable multitude of men at one time. Nor has Schurigius, although he collected all the examples of deaths of this kind from every author, found any example that relates to women, two instances excepted, which not the histories of physicians, but certain inscriptions have supplied; and whether these were genuine or forged, neither he, nor those from whom he copied them, have enquired. And although Valerius Maximus says, that those



persons who have died thus, have not died "by reason of their own lust, but merely from the frailty of human nature; for that the termination of our life being exposed to various and occult causes, this event is frequently attributed to causes which are by no means accessory to it, as they rather happen at the time of death, than give occasion to it of themselves;" yet dissection, and reason also, sufficiently demonstrate how much the indulgence of venery, added to those causes, accelerates death, by exciting the circulation of the blood, and by bringing on a rupture of occult aneurisms, or even by bursting some weak vessels within the cranium: which, without this or some other similar cause, would have continued to do their offices much longer, and perhaps even to old age, as had happened in that man in whom I observed what I shall immediately subjoin, and whom I dissected in the college the year before I dissected that strumpet.

15. A fat old man, of about sixty years of age, had died suddenly of an apoplexy, as was supposed by those who had known him to labour under a tremor. The pericardium, according to the account brought to me, (for I did not dissect this, though I did the other parts) was distended with as great a quantity of blood as two glass vessels, in which the blood taken from a vein is generally received, would contain. The heart was enlarged, and the great artery dilated above the heart; and even in its whole curvature was distinguished, on the internal surface, with bony scales, some of which kind were also found in the arteries of the limbs. From the same surface, not at a great distance from the heart, a foramen big enough to admit a finger took its origin; and going on through the coats in an oblique course of almost four fingers breadth, from below upwards, it at length opened on the external surface of the artery within the pericardium. And by this passage the blood had been discharged into that cavity.

16. Although it does not certainly appear at what time the aneurism began in this man, yet it is most probable that it had begun at the same time of life in which most others begin. At least, those diseases of the artery that I have described do not seem likely to have happened within a short space of time.

Diseases similar to these were discovered by their proper marks, for two or three years before death, in a woman whose similar exit from this life I shall immediately relate.

17. A woman, of a fat habit of body, of fifty years of age, of a sober disposition, and naturally rather inclined to sadness and taciturnity; who had already been fourteen years a widow, being subject to no disease, except that for the last two or three years, that is, ever since her menses had been leaving her, she had been every now and then troubled with a kind of wind, as she called it, about the heart and its neighbourhood; having risen early in the morning to her work, for she was by trade a weaver, and having got every thing in readiness that is necessary to begin a new piece of work, cried out Oh! and spoke not another word, but died instantly, as she leaned with her arms on the beam. It was the same month of the year 1729, in which, as I formerly wrote to you, so many others in this city were taken off by a sudden death; wherefore, although this woman died in the country, in that part which is called Pons Medoaci, taking its name from our neighbouring river, yet thither the physician and surgeon whose business it was, were sent to dissect the body.

The neck and arms were rigid; so that they could not be bent without force. The cranium being cut open, a great quantity of blood immediately flowed out; and it seemed to them that some vessel betwixt the cerebrum and cerebellum was ruptured. This, however, was more certain, that when they examined the thorax, the pericardium was so extremely distended, that when they made a puncture into it, a bloody serum rushed out. And the remaining part of the blood adhered about the heart in a coagulated state, like a pretty thick bark. Nor did they only relate these things; but they brought the heart, with the vessels annexed to it, in an untouched state, with them, that I might examine them accurately. And this I did on the day after, while the same persons and others assisted; and I found the parts in the following state: The heart was small, but, nevertheless, furnished with fat, of a healthy appearance, and, as far as relates to the left ventricle, with pretty thick parietes. There was no blood in that or in the other cavities, nor any in the large vessels;

I do not say fluid blood, but even not coagulated, and still less polypous. All the other parts of the heart were found, if you except the borders of the valves that are called tricuspides and mitrales, inasmuch as they were universally distinguished by a small, roundish, and fleshy kind of tubercles, resembling glands. But these appearances are, certainly, not rare; and indeed, have been already described to you in many bodies. This, then, being the state of the heart, and nothing being found to exist that was preternatural in the other vessels which are annexed to it, the great artery was the only one that remained to be examined. Having, therefore, opened that tract of it which was fixed to the vertebrae of the thorax, and having first observed a whitish spot, and in the next place, at a long interval above this, another of a larger size, and of a yellowish colour, the marks of a future ossification; I in like manner saw, internally, an oblong, but small prominence, where the artery began to descend, formed of the natural substance of the artery, but itself by no means natural.

After this, before I continued to open it farther, I observed that the artery was, from that part whence it sends off the left carotid, almost quite to the heart, much wider than it ought naturally to be. But soon after, having laid it quite open, I saw, in the whole of this large extent, which I said was dilated, that the artery was internally rough and unequal, by reason of rigid and hard bony lamellae which were so thickly sprinkled, and in so great a number, as scarcely to leave some very small intervals betwixt them. And as, in these intervals, the internal coats of the artery were perceived to be corroded and attenuated by a kind of ulceration; it was surprizing that what any one would suppose might have happened, in so many other places before, should at length only have happened in one place, and that at the posterior part of the tube, and somewhat to the left. That is to say, the blood had, by degrees, made itself a way through one of the intervals of this kind, and had come out under the external coat of the artery; and first by drawing it from the internal coats, and then by raising it, as a large kind of ecchymosis, which itself had formed, by coagulating there, demonstrated to us; and finally, by distending it more and more, had burst through this

external coat in one place, and had poured itself out within the pericardium. However, those branches which went to the head and the shoulders, notwithstanding they came from so diseased a stock, were all of them, as far as I could conjecture from the parts of them which were annexed, entirely sound.

18. In regard to the bony lamellae, and the ulceration of the aorta, that attended them, I shall enquire into these in the next letter, to which, for this reason, I defer a singular observation, that otherwise belonged to this place, which is an observation communicated to me by a celebrated man, of a sudden death from blood having fallen into the pericardium through a foramen of the great artery, which was much diseased. But you, in the mean while, wonder that those deaths should be so sudden, from no greater a quantity of blood being extravasated than the pericardium can contain: the capacity of which is so defined by Boerhaave, as to be twice as big as the heart; and by Fantonus, that besides the heart, it can receive "almost two pints" of water. And if we suppose it to be, not only filled, as they have supposed, but also distended, as is shown in the women that I have described, by the serum issuing forth with such an impetus; and if we even suppose it to be relaxed besides, as in the old man, so far as to be able to contain the quantity of blood they related; yet we ought not to forget, you will say, how much a greater quantity of blood, beyond any comparison, sometimes comes forth in haemorrhages within twelve or fifteen hours, as Litré testifies, without bringing on death; not to mention the ancient examples which are extant in Schenck, of twenty pounds of blood being discharged within five days, and even within one day and two nights; or of forty pounds flowing within six days from the nostrils, or of twenty-five within three days from the uterus, without the lives of the patients being destroyed thereby: and that women, in particular, have in general more blood, and more easily bear evacuations of this kind, does not seem at all doubtful: and as things are to be considered in this view, it seems probable, that the woman of whom I spoke last, was, perhaps, taken off by an apoplexy, rather than by the rupture of that aneurism.

If you say thus, I shall beg of you, in the first place, to attend to the difference that there is, betwixt a large quantity of blood being discharged at once, and a far greater quantity being discharged in the course of many hours and days; and in the next place, betwixt blood flowing from the very trunk of the aorta, near its origin, and that which is discharged within the pericardium, and on the outside of the body. And the first difference will show you, that in this case there is not sufficient time for the vessels to contract themselves about the remaining quantity of blood; nor yet for the blood to receive any supply, from which the parts of this fluid would become contiguous to each other, and to the coats of the vessels internally, without which the circulation of the blood cannot be carried on. And from the second difference you will, at the same time, perceive, that a proper quantity of blood is suddenly withdrawn from the whole body. And from the third you will conclude, that the heart is certainly injured by the unusual contact of blood externally, and that by the quantity of this fluid lying round it, the proper action thereof is impeded: and that if a fluid distend the pericardium, it must also press upon the heart.

Nor let it be any objection with you, that in a dropsy of the pericardium the heart continues to be moved; for it is one thing for the water to be gradually encreased, and another thing for the blood to be suddenly extravasated; one thing for the heart to be pressed upon by water, and another to be pressed upon by blood; which, besides that it is prone to coagulation immediately upon effusion, without doubt approaches the more nearly to the nature of solid bodies, in proportion as it is thicker than water; and if a solid body be applied to the heart, it immediately brings on a syncope, by stopping the motion of it, as the very celebrated Senac demonstrates, by the examples of a probe, or a finger, being applied to it, in the cases of two wounded men, in whom that symptom was thereby brought on. Or if these are not sufficient, add thereto the two first differences I mentioned. Add also, that the trunk of the aorta was dilated, and that the fleshy fibres being in great measure eroded, it had rigid little bones within: and it is very evident how much difficulty must be thrown in the

way of the blood's circulation, by circumstances of this kind; and consequently, how much greater powers of the heart are required, in order to overcome them, which, it is very certain from what I have already said, were greatly weakened and injured. But if all these considerations, summed up together, should perhaps not be able to satisfy you, and you would rather choose to suppose, that this woman was taken off by an apoplexy, by reason of that quantity of blood which appeared within the cranium, than by the rupture of the aneurism, read the histories of two women that follow, which are not much unlike the one already given; except, however, that no blood at all, not to say that great quantity which seemed to be extravasated within the cranium, was found by us.

19. About the middle of May, in the year 1738, a woman of more than thirty years of age was carried off in this place, by a sudden and unexpected death. The belly and thorax being opened, in the former a little extravasated water was found by our Mediavia, but in the latter none at all; however, the pericardium was filled with blood, from an aneurism, not only the whole curvature of this vessel had dilated itself, but also the part nearest to the beginning of that curvature.

The head and the greater part of the viscera I dissected myself. But within the cranium I found no greater quantity of blood than what was sufficient to render the vessels of the pia mater moderately turgid, as they in fact were, and to furnish the small red drops, that appeared up and down in the medullary substance when cut into. In the lateral ventricles was no great quantity of turbid water, nor any paleness in the choroid plexusses. But the other circumstances that I observed in the brain, the nerves, the ears, and in other parts, and particularly in the *renes succenturiati*, do not relate at all to the present subject; for this is that woman from whom I described the right of these bodies as endowed with a peculiar form, in the twentieth anatomical epistle.

20. I will now subjoin the whole of that observation, one small part of which only has been given in the sixth of the *adversaria*. For although it was the first wherein I saw an aneurism of the aorta ruptured within the pericardium, yet I designedly deferred

giving you the relation of it till at present, because it contains many and various things, and requires many and various remarks.

21. A Venetian woman, of the same age as the last I have described; of a stature, colour, and habit of body that were laudable, but rather fattish; being the mother of many children; and having been, ten years before, seized with a palsy of the lower limbs, was said to be made sound by the use of rosemary; or, at least, she had been subject to no inconvenience from that time, which was worthy of remark: but, for some months past, had laboured under a difficulty of breathing, which, however, was not continual; and besides this, with a pulsating tumour that ran upon the neck, longitudinally, in the region of the right carotid artery; yet never (which you will remark, on account of those things that we found in the dead body) did she complain of any pain, numbness, or tumour of the right arm. But four or five days before her death, she complained of a troublesome kind of sensation, just as if her ribs, as she said, had fallen towards the abdomen; when, on a sudden, about the middle of December, in the year 1708, being seized with a kind of fainting, and affirming that she should die, she was with great difficulty supported by the women, who ran to her, and placed her in bed; where, her face, and particularly her lips, being livid; she, being cold and senseless, with a very small pulse, a difficult and slow respiration, departed this life, in less than a quarter of an hour from the time of her being attacked.

Upon inspecting the body, it exhibited no oedematous tumour in any part, or any thing else that was worthy remark; but when the belly was opened, some parts of the intestines appeared to be, as it were, inflamed, if you attended to the colour: which colour was soon after obvious in the pancreas also. But upon examining the small intestines more attentively, in one part of them, to the length of a man's hand, appeared some very small and innumerable tubercles of an obscure kind, which were nothing else but tokens of the cells, that being distended with air, betwixt the fleshy coat and that which lay beneath it, lifted it up outwards; the air, therefore, having escaped, by means of wounds in the nearest sanguiferous vessels, these cells collapsed.

In the gall-bladder were four or five little stones, of an unequal magnitude among themselves, which being applied to the flame took fire. From the vena cava, when cut into, a considerable quantity of blood flowed down; but from the great artery only a small quantity. The viscera of the belly being now sufficiently inspected, and for that reason removed, it was evident that the diaphragm did not ascend, on both sides, in the form of a vaulted roof; but that it rather fell downwards.

When the thorax was opened, we saw that a very bloody serum had been extravasated in both the cavities of it, to the quantity of a few ounces: but that the lungs were found, although something turgid; for the bronchia, and especially the left, as I afterwards saw, were filled with a serum like that I just now spoke of. In the mean while, the pericardium, by its tumid and livid appearance, had given marks of its having blood extravasated in it: with which, however, it was not full; but contained somewhat less than a pound; about two ounces of which were a bloody serum; the remaining of the blood having formed itself into a thick and pretty firm lamina: whereas all the blood that I saw in this body was black, indeed, like this, but quite fluid. The blood being taken from the pericardium, as we saw that the aorta, as soon as ever it came out from the heart, was manifestly dilated, by pursuing the trunk and the principal branches thereof, I found that the former of them was dilated almost quite to the emulgent arteries, and that the branch of the aorta, which is itself a common trunk of the right carotid and subclavian, and, in like manner, that both of these branches were so dilated, as to make the breadth of the carotid, from the beginning of it quite to the division, more than twice as large as it ought naturally to be; and the subclavian artery, to the extent of three inches, was not expanded equally on all sides indeed, but had its posterior and superior paries only curved out into a prominent aneurism; by means of which, nothing at all being interposed, two or three nerves, of those that go from the neck into the upper limb, were compressed. From this aneurism, which would have admitted my thumb, two arteries proceeded: these having a broader beginning than they naturally have, put on the form of a cone, and



the farther they proceeded the more they were contracted; till having measured out the space of an inch and a half, they were reduced to their natural dimensions. One of these went to the thyroid gland, which was in this woman large, and in some places hard.

After having examined all these parts externally, I began to lay open all these vessels, and even that part of the aorta which had been in the belly, in a longitudinal direction, beginning with the iliacs. And from these arteries quite to the emulgents, I found no appearance of disease, except whitish spots in some places, and very small furrows here and there. But as the dilatation of the trunk began above the emulgents, so from thence, quite to the heart, the parietes of the artery were much thicker than they usually are; yet not equally in every place, and were, in like manner, more hard and rigid than usual; although I found no where any appearance of ossification; but in some places whitish spots, in others very considerable parallel sulci, drawn in a longitudinal direction, and so much the more remarkable, as they were interrupted, after having run over a short space, by other transverse sulci, the direction of which was not near so strait; after that others followed, similar to the former, which were presently interrupted by transverse furrows; and after these still others in the same manner: so that in this morbid constitution a kind of elegant order was preserved quite to the whole arch of the aorta; and, indeed, it was continued from this curvature into the left subclavian to the extent of an inch; into the neighbouring carotid to the extent of two inches; but into the other through the whole of it, together with the spots, the thickness and hardness of the coats. But that aneurism of the subclavian resembled the structure of an auricle, as it were, of the heart, formed of an unequal, hard, and thick coat, not internally lined with polypous laminae, or strata, but only having a very small, whitish, and oblong jagged concretion adhering to it; besides which, I found no other polypous concretion in the whole body.

Finally, the trunk of the aorta itself, from that place where it sends off its first branch to the upper parts quite to the heart, was both distinguished with spots, and marked out into furrows; but

these were so confused and irregular, that nothing but a perpetual and very great inequality of that surface appeared. Yet, besides this, a kind of ulceration, as it were, was found about two inches above the semilunar valves, where the artery looks towards the right and posterior parts; and in that ulceration were three or four very deep foramina, very near to each other, each of them of the bigness of a lentil, but of an angular form rather than round. From these foramina, winding sinusses were carried obliquely outwards, and reached to the external lamina of the aorta; which was in that place, therefore, of a brownish colour mixed with red, as if in consequence of inflammation, and become much thickened by a great flow of moisture: and in the middle of that redness, the lamina being at length lacerated, the blood had made a way for itself into the pericardium, by a foramen similar to the internal foramina, and almost of the same magnitude.

The left ventricle of the heart was greatly dilated; but the auricle that lay close to it, was very much contracted and thin. In that ventricle, and in the right, blood was not wanting; and in the pulmonary artery there was a great quantity; nor were the carotids, nor the jugular veins devoid of it.

Finally, I found the cerebrum and cerebellum to be very lax, notwithstanding there was no water in the ventricles, a very little of which was found in some places only under the pia mater. The vessels of this membrane were somewhat turgid with blood. The vertebral arteries, where they entered the cranium, seemed to be a little wider than usual. The other circumstances that were remarked in this body by me, and by my friends, that assisted me in the dissection of it, relate to other subjects.

22. There were found in this woman four aneurisms at least; one of the left ventricle of the heart, one of the greater part of the aorta, one of the right subclavian, and one of the carotid on the same side; so that there not only appears to have been sufficient causes for the symptoms with which the woman was troubled, but it is even surprising that she had not been afflicted with more. As to the aneurism of the carotid, which discovered itself by its prominence and pulsation, although I readily confess that these arteries are sometimes dilated, from peculiar causes

that affect them in particular; yet that their dilatation is joined more frequently with the dilatation of the aorta, and is even a propagation and effect of it; nobody since the time that the causes of diseases were begun to be enquired into, by frequent dissections, will deny. The ancient physicians, indeed, being in want of this assistance to their enquiries, seemed to suspect nothing of that kind; and thought that they had nothing else to do in an aneurism of the carotids, than to make a revulsion of the blood; to diminish and correct the acrid particles in it; and, finally, to apply such things as had a property of contracting and constringing the coats of the arteries; as you will very clearly perceive from reading that chapter of Arantius, in which he particularly treats of this aneurism. But if any one attempt to constrict the artery, when it is a production or effect of an aneurism of the great artery, he will encrease the latter, and not remove the former; but he even will not be able to effect this, when it is only from an eroding cause, as Lancisi shows, by producing an example of a noble matron.

23. But as to the aneurism with which the right subclavian artery pressed upon the nerves that went to the upper limb, without any thing at all being interposed, I enquired in the sixth of the *Adversaria*; where, by I know not what negligence, "the left subclavian" is written instead of the right; I enquired, I say, why no mark of this compression had existed in the living body? Nevertheless I still enquire. For since pains, as is frequently the case, and was the case in the man whose history is written above, or numbness, happen to those in whom an aneurism is formed in the trunk of the aorta itself, above the heart; I see that the circumstance is explained by learned physicians, by means of contractions, which being propagated from that run into the subclavians, compress the same brachial nerves whereof we speak at present; why then are not these nerves so much the more compressed by an aneurism seated in the subclavian itself, and contiguous to them? For although other very experienced men are not wanting, who affirm that sense and motion has, finally, been observed to be quite uninjured in that part to which the nerve goes, when the nerve has been not only compressed, but

even for a long time closely confined by a ligature; yet they do not, nevertheless, deny, that immediately after the ligature was put on, at least some loss of sense and of motion had been perceived. Is the reason of this that the nerves bear with impunity that compression which is brought on gradually, and gradually increased, by custom accommodating themselves thereto? But of these things you will consider, as also of the greater number of experiments which have been lately made by more than one person, in which some circumstances occur in a different manner from what I have just pointed out, that ought not to be passed over with neglect: and you will likewise consider of those observations, which I here purposely pass over, from which, perhaps, it would not be altogether absurd to conclude, that the small branches of other nerves which communicate with the branches of those that are tied up, may, by degrees, and after some time, be able so to dilate their tubular cavities, as to carry supplies to them transversely, in the same manner as happens in the sanguiferous vessels.

Of these things, I say, and of others you will consider. For what I was unwilling to do then, I am equally unwilling to do now; I mean, to entangle myself in abstruse and tedious disputes about the nerves. It is much better to remark every thing that occurs to each of us upon the subject, till a proper number of observations and facts shall show us what we may follow; sparing, in the mean while, some certain conjectures; and making inductions with caution, which, although they may be easily defended, yet we do not all attain to the knowledge of: how much less likely is it, then, that we shall attain to the knowledge of the truth, which is, as yet, so deeply mysterious and involved?

But you, perhaps, will rather ask on this occasion, why the disease, which was propagated from the aorta to the right carotid and subclavian arteries, was not equally propagated into the left carotid and subclavian? And this I should suppose to have happened for more causes than one. For, in the first place, the vessels on the right side are nearer to the heart than the left, if we consider their first origin. Wherefore, as the powers of the heart were preternaturally increased, the former began sooner

than the latter to be weakened; for which reason, the disorder that afterwards began in the arteries on the left side, was, I saw, carried farther on in the carotid, in consequence of this vessel being nearer to the heart, than it was in the subclavian. And in the second place, whatever was the occupation or handicraft of this woman, in regard to which I have no certain information, it is highly probable, that she had been accustomed to use her right arm more frequently, more strongly, and for a longer continuance, than she did her left; and that there is room here, in some measure, for the explication of the celebrated Maloet, who accounted for the dilatation of the subclavian artery in an artificer, from the more frequent, constant, and stronger contractions of the muscles of the right limb; that is to say, from the blood being retarded in the arteries of that arm which are so compressed, and consequently more accumulated in the origin of these, the subclavian, which is by no means liable to those compressions. What? if in this woman another cause of that dilatation was added; I mean, stays, which are furnished, as Petronius says, *balenatiis virgis*, "with rods of whale-bone," which, by their too great hardness and confinement under the arm-pits, as frequently happens, would so much the more press upon the artery, in proportion as the artery should be more pressed against that hardness in the motions I have just now mentioned, and for that reason reflect the impetus of the blood, which was strongly driven by the heart into the subclavian artery, back upon this artery. And if you do not disapprove this supposition, you will add it to the other disadvantages that the very ingenious Winslow has imputed to this kind of stiff stays about the chest, which too much constrict the axillary vessels.

Finally, if all these causes joined together do not sufficiently explain the circumstance, call to mind what Celsus has very justly said: "It happens but seldom, that a person has not some part of the body more weak than the rest." And if you admit of this supposition, you will not only understand why that subclavian artery might be subject to an aneurism, but even why it might have one in that particular part.

24. But in regard to the aneurism, and the other disorders of

the aorta itself, as we have made many remarks in other places, it will be sufficient to add only a few things at present, that relate in particular to these diseases. And first, that the artery was more thick and more rigid than usual; whereas one would naturally suppose that, by reason of its dilatation, it should have been thinner and softer; arose chiefly, in my opinion, from those very thick and whitish spots, which, as they are the beginnings of a future bone, are, in like manner, made up of an increased substance in that part, which approaches, as I have often observed, to the nature of that which is in the ligaments. And that these spots, and the other diseases of the heart, were so much the more frequent and considerable as the aneurism was less distant from the heart, you see was owing to the impulse of the impinging blood, which must be driven on with a greater force in proportion as it was nearer to the heart. For which reason no more need be said to make you conceive how it happened, that as a part of the aneurism was within the pericardium, it was ruptured within that cavity, as it also happened in many other cases which I described above. We should rather endeavour to explain why the aneurism was ruptured at the posterior part of the artery. For as I saw it to be opened in that part also in the woman-weaver; and as the orifice of the aneurism was likewise described in that part in the strumpet; it becomes less probable that all these women had the same one part of the artery in particular weaker than the others. It is, perhaps, more supposable, that this circumstance was owing to the weight, and at the same time to the impulse, of the blood that came out from the heart, as the position of the artery seems to show; which, as it begins to incline to the posterior parts immediately from its origin, consequently subjects that part of itself to the weight of the blood, and at the same time lays it in the way of the blood's impulse.

Perhaps you also wish to know why, when the artery was ruptured, this woman did not immediately die also. I suppose, because the foramen was, at the first, much less than I found it; as appeared from the blood being effused in less quantity than in other persons: although it was also effused in less quantity, and slowly, on account of the powers of the left ventricle of the

heart (which had been formerly, indeed, when they distended the aorta, very great, but in the latter part of his life were weakened and broken down by all the disorders of the aorta itself) strongly, and for a long time, resisting; as the great dilatation of this ventricle demonstrated. And whether this slow extravasation of the blood, which entirely agreed with the very slight motion of the heart, as was signified by the pulse, was the cause of this blood having coagulated in the pericardium; which was a circumstance that appeared in no other part of the body whatever; or whether the water in this cavity, which, perhaps, by reason of the disorder of the heart, was previously morbid, could effect this concretion; or whether there might be any other more probable cause that escapes me now; I leave quite undetermined.

25. And as to the aneurism of the heart, and in regard to this of itself being frequently the cause of sudden death, I have already spoken of these subjects in other letters, and shall treat of them hereafter. It remains to add something upon that sensation which was troublesome to her in her last days, and seemed to herself to be that of her ribs falling down, as it were. The ancient author of the book *De Veteri Medicina* has said, that when they omit their dinner who have always accustomed themselves to eat a dinner, their "viscera seem to them to be hanging downwards." And this had been handed down in so many words in the book *De Victus Ratione in acutis*; and in that part too, which, from the testimony of Galen, is supposed to be "the most genuine work" of Hippocrates: nor did they judge differently in the time of Pliny, who would not otherwise have said, "that Hippocrates had dedicated one whole volume to the praises of ptisan;" for there is not the least doubt, but that by these words he meant the same part as Galen did, whether he attended to the long discourse that is made here upon ptisan, or whether he read this book in the codex, in which it was entitled *De Ptisana*, in which manner Galen saw it inscribed, and under which title Caelius Aurelianus has quoted it: which Duretus, who was a man in other respects very learned, may seem to have forgotten, when he has supposed that this title had been "given to it by Pliny," whose authority, rather than that of the Grecian manuscripts which they had in their

hands, I suppose neither of these authors would follow in such a circumstance, as they have not, on any occasion that I know of, ever spoken of Pliny. And Dalechampius thinks, that those very words of Hippocrates which I have quoted relate to this circumstance; since he has said in another place, for instance, "that Hippocrates asserts the entrails of those who eat no dinners to grow old very soon;" for these words are interpreted thus, "that they are tortured with a pain at their praecordia, as if their viscera were hanging downwards." And the opinion of Thevartius is the same in the annotations to a certain consultation of Ballonius, except that instead of *senescere*, "or grow old," he judges that we should read *pendere* & *succrescere*, or that they "hang and grow downwards." What if Pliny should not have had an eye to those words in that passage; but to that place of the second book *De Diaeta*, where it is said, "To take food once in a day attenuates and dries," . . . but "that dinners have quite the contrary effects;" and so that in Pliny it should have been written *siccescere*, or "grow dry?" What if we suppose that one letter only has been altered, and that instead of *senescere*, or "grow old," it should be written *sanescere*, or "grow healthy?" On which supposition Pliny may be thought to have had some other passage of Hippocrates in view; which I omit to enquire after, as the opinion of Pliny, by reason of the corruption of his words in that chapter, seems to me to be not altogether so clear and certain as I could wish. But the opinion of Hippocrates in that former passage seems to be by no means obscure, notwithstanding different interpreters have thought that he meant quite different things. For Franciscus Vallesius says: "The viscera in these persons seem to be suspended; that is to say, they seem to be drawn upwards; because the vessels being emptied, they are in a manner convulsed." Others, on the contrary, understand, that the viscera seem to be so suspended, that the patient feels them to be drawn, not upwards, but downwards; where, without doubt, the very weight of the viscera would draw them, just as if a kind of fulcrum, or support, were taken away; and that this fulcrum had before been the stomach, when it was filled with food. And to this opinion the interpretation of Duretus relates, which I



do not doubt but Ballonius has read, as he delivers the same thing in the same words. And this opinion Thevartius not only follows in his annotations, but even confirms the interpretation by another passage of Hippocrates; who teaches us, that in a fracture of the ribs, "a moderate repletion of the belly becomes a direction and support to the ribs; but that an emptiness of the belly makes the ribs hang downwards; and that this depending state causes pain." And Galen, in explaining this passage, is so far from doubting "whether the tumour of the belly is made a foundation for the ribs to support themselves on," or, as he speaks soon after, "their seat and prop," as to affirm, that "they who have pretty large bellies, are wont to be troubled with less pain if they have their ribs broken; and that they who have their bellies small and contracted, feel great pain from a fracture of this kind, as they feel the ribs weakened, and, as it were, suspended." But it is more easy, you will say, to conceive of this, I mean, how the belly, when tumid, may support the ribs, than of the other; that is to say, how the stomach, when tumid, may support the viscera that are laid upon it. For although, when it swells, it may turn the fundus, not downwards, but forwards, and by this means be able to support the spleen, and the lower part of the liver; yet it cannot support the side of the liver, that is more to the right, which is much the heavier. And to this you may add, say some, the intestines that lie under this part, and under the stomach itself, and, in particular, the colon: for by this means you will perceive, that these parts and their vessels, being filled, sustain both the liver and the stomach equally. To which if you reply, that you do not enquire after this at the time when the intestines and the vessels are filled, but when the stomach only is filled; for that this sense of the viscera hanging down, as it were, is not then at length removed after the ingesta have reached to the intestines, and in particular to the colon, and filled their vessels, but long before; the same persons will know how to set the whole of the circumstance in a more distinct view, and clearly to show what the muscles of the abdomen contribute thereto, even when the stomach and the first part of the intestines are filled, and perhaps what that vigour which we feel diffused through the whole body

the very moment that refreshing aliments are thrown into the stomach; I say, what this vigour contributes to affording these supports of which I spoke, and raising up the viscera in some measure. I think I have now said quite enough, in order to make you understand from whence that sense of the ribs falling downwards, as it were, arose in this woman, whose strength and appetite were extremely languid, as the disorders of the great artery, and of the heart, proceeding from those causes that I have demonstrated, required. To these, moreover, was added, what was observed in the dissection, to say nothing of the cerebrum being very lax, that the diaphragm, before the thorax was touched, did not ascend on both sides, but rather fell downwards: for if this had happened to be in some measure brought on in the last days of her life, by reason of the power of restoring themselves to a natural state being weakened in her muscles, you easily see that those parts of the diaphragm, from whence the liver by its right and left ligament, and the spleen, also, by its proper ligament, are suspended, are drawn downwards by the weight of the viscera; and that the ribs at the same time, inasmuch as they are annexed to the diaphragm, are under a necessity of following this.

26. However, I partly know, and partly suspect, that others have before also lit on cases similar to these that are above described by me. I know that Boschius has seen a case of this kind "twice;" for in the eighth section of the second book of the *Sepulchretum*, you will read that it was observed by him "twice, in those who laboured under a palpitation of the heart, and who having the coats of the aorta dilated, were seized with a sudden death, as it were, because the spirituous blood had rushed headlong, in a manner, into this coat called the pericardium;" for which reason the heart could not be dilated. And I suspect it, when I read in this eleventh section, that the body of a person "who died suddenly from anger," had shown "the pericardium to be filled with blood;" and "had two abscesses found in the trunk of the artery, near the heart, from whence the blood had flowed out." For certainly it is much more probable, that they were two small aneurisms stuffed up with polypous concretions,

which, without examining the aorta internally, were taken for "crude and bloody or inflammatory abscesses, not yet suppurated:" such as could not be ruptured from anger, and when ruptured could not have poured out such a quantity of blood; although the great artery being even examined internally and externally in our times, and found to be corroded on both sides, near the heart, as I have often seen it, from whence the blood had burst suddenly into the pericardium, both this bursting of the blood has been considered as an uncommon case, and that corrosion taken for an abscess of the aorta, which was, however, better conceived of, and explained.

But, to return to our suspicions; you have, perhaps, read the history "of a very fat man, who complained of a palpitation and pain of the heart, with an unequal, and sometimes a faltering pulse:" after whose death, which happened "suddenly, while he was at stool, the pericardium was found full of coagulated blood, of a very black colour, and a very filthy odour; and appeared so formed in the superior part, as to resemble, in substance, the *renes succenturiati*." It is true, I would not pretend to deny that tumours of the pericardium may be formed, which may be ruptured within this cavity; and I confess the ill smell of the blood agrees very well with a supposition of this kind: but I say this nevertheless, that if any man more studious of, or better skilled in, anatomy, had lit on that case, he would have set about to enquire, from whence so great a quantity of coagulated and very black blood, that is without any mark, as far as the eyes could judge, of ichor or pus, had suddenly proceeded, and whether the large vessels were sound; and since, about these vessels, (for it was thus that he pointed out the upper part of the pericardium) that substance had appeared, whether only one of them was eroded, or pierced through.

For this may happen not only to the aorta, of which I have spoken hitherto, but also to the pulmonary vein, and the vena cava, as I shall say presently; and to the pulmonary artery also, from the erosion of which, the celebrated Tabarrano mentions, that blood bursting into the pericardium, had been the occasion of sudden death in the cardinal Boncompagno at Rome: and I

formerly heard at Bologna, from my praeceptors, who were his physicians, that he had been used to complain of most of the symptoms which are mentioned in the case described just now. Whether, therefore, the blood had issued from the pulmonary artery, or from those veins, or, finally, from the aorta itself, (for I have found the blood which had come from this vessel, to be black also, and not of a bright red) I leave quite undetermined, not only in the observation described above, but equally in another likewise, which you read in Ramazzini, of "man of sixty years of age, of a very fat habit of body," who died a sudden death, and from whose "pericardium almost two pounds of coagulated blood were extracted;" and finally, in that which is extant in this section of the Sepulchretum, of a soldier "who died suddenly, after a long state of grief;" and who, at the same time that "the other viscera were sound, had in the pericardium, not only water, but also a great quantity of concreted blood." Where, notwithstanding, you will also see it inculcated in the scholium, that the heart had been overwhelmed and oppressed, "both by the quantity of water, and by the blood," yet it is by no means necessary that you should believe there was any other water than the serum generated in a very considerable quantity, as frequently happens, from the remaining and coagulated part of the blood. In these histories, therefore, it is certain, that the blood had burst into the pericardium from some pretty large, or, at least, from some moderately-sized vessel being pierced through with a foramen, and not from a very slender one, especially if it was a vein; for the blood flowing down very slowly from a small vessel, or through a very small foramen, as it would have been increased to such a quantity gradually and slowly, would not have brought on so sudden a death. But from what vessels it had been discharged is uncertain, by reason of the unskillfulness or negligence of those who performed the part of dissector. For the blood being taken out, and washed away clean, a foramen of that kind could not be concealed, whether it was in the ventricles, or in the auricles, of the heart, which we here comprehend under the general name of vessels, or in the other vessels properly so called; and not only in the very largest, but even in those of a moderate size;

of which kind, particularly at the basis of the heart, are the coronary vessels: for it was found that the blood, with which the pericardium was distended, in a matron, and, in like manner, in a soldier, who were taken off by a sudden death, had flowed out from a rupture of the coronary artery. And if the foramen had nevertheless escaped the eyes even of a skilful and attentive man, it must have been very easily discovered by injecting air or water through the veins to the heart, and into the heart, and from the heart into the arteries, in a proper quantity, at the same time making a ligature on the arteries without the pericardium.

But if after a death that is not sudden, of which the question is not in this place, blood be found within the pericardium, you must suppose this to have distilled gradually from the smallest vessels and pores: as, for instance, in the two observations of the celebrated Laubius; especially, since in the first of them, the surface of the heart appeared to be, in a manner, corroded. And I would have suppose the same thing of others, which you will find to be of the same class with these, out of the many that the very learned Senac points out besides. But do not readily imagine, that those which he takes notice of among the rest, as being taken after a sudden death, could have been made without a foregoing corrosion or rupture of some large or middling sized vessel or repository of blood; for instance, as he expressly relates, in two of the aorta, or of one of the pulmonary veins. However, the rupture most frequently happens in the aorta, when it happens in the arteries; and in the vena cava, when it happens in the veins: in the former vessel generally for those reasons, on account of which I have already asserted aneurisms to happen in that, rather than in the pulmonary artery; and in the vena cava, for those reasons that I shall immediately hint at. For why this happens sometimes in the heart, we shall see in the next letter.

27. Although all the blood must, of course, pass through the vena cava, as it passes through the pulmonary vein; yet there are many things which may render its passage more difficult through the former than through the latter. In the first place, the opposite and almost adverse channels of the superior and inferior cava, so that to the difficulty of the ascent on one hand, is added, on the other, the weight and impetus of the blood rushing from

above downwards. In the second place, the crude and thick juices, not yet mixed with the blood, with which the effete blood of the cava is loaded. And, finally, the obstructions which, by the force of diseases, or passions of the mind, or from any other cause whatever, may be thrown in great numbers in the way of the speedy motion of the blood, through the vena cava; inasmuch as they may exist, not only in the right cavities of the heart, but in the pulmonary artery also, and the lungs, the pulmonary vein itself, the left cavities of the heart, and the great artery. On the other hand, the trunk, or if you choose rather to call it so, the sac, of the pulmonary vein is simple, and receives the blood, when driven thither by the agitation of the lungs, and that in a vivid, comminuted, and mixed state; nor can it, of itself, have any other obstacles to oppose its motion, besides those which, after the lungs, I have said may be common also to the blood, that is about to flow through the vena cava.

And this being the state of the matter, and examples of dilatation of the pulmonary vein, at the same time, not being wanting, nor even examples of its rupture; for to put that out of the question, which is related from Parey, "the pulmonary vein has been sometimes found" by Bellini, in those who have died suddenly, "to be pulled asunder from the left auricle," which Francis du Queye also saw at Montpelier; both the dilatation and the rupture will happen so much the more easily in the vena cava, in proportion to the number of causes that I have shown to exist, by which the blood may be retarded therein, and consequently accumulated; and being accumulated, may weaken and draw asunder the fibres of its coats; from whence, by the quantity of blood that is urged on, the vein may be first dilated into a varix; and after that, by reason of the extenuation of the coats, which is the consequence of dilatation, or even on account of the erosion, which generally succeeds to the distraction, may be ruptured. But the varices of the cava, unless they are very considerable indeed, are less obvious to the eyes of the dissector than the aneurisms of the aorta; for the veins collapse, by reason of the thinness of their coats, when the blood is taken out of them; which happens when the cava is cut into, in the belly.

Wherefore, when there is any suspicion of disorders in the

cava, the dissection ought to be begun from the thorax: or if the blood, by reason of the body having been previously examined by others, and the viscera of the belly being taken out, has happened to be discharged, care must then be taken to inject a sufficient quantity of air or water, in order to show you what is the full breadth of the cava: and that in particular, when you have observed the right cavities of the heart to be affected with too great a dilatation, or contraction, or even the left: for hence it also happens, as was said just now, that the motion of the blood being retarded, the cava may be dilated; as is shown in the first of the histories of Vieussens, that are given in the sixteenth chapter of his treatise on the structure of the heart.

28. But whether Aretaeus hinted at this disorder, or any other of the vein, when he wrote "that arise *ῥέδματα* in this vein, when the blood bursting forth copiously, very soon destroys life," I omit to enquire; not only on account of the various lections in that part; as Peter Petit would have it, "if a ruptured vein pour out its blood;" but in particular, on account of the very extensive signification of that word *ῥέδματα*, which is thus explained according to Galen, in the Exegesis, "old disorders from a flux of humours." This is more certain, that Aretaeus speaks of the rupture of this vein, and first in the thorax; as those things which he immediately adds, demonstrate: although the passage does not appear by which he carries the blood from that when ruptured, into the lungs, and the aspera arteria, from whence it may be discharged. But the rupture of the cava, which was conjectured by Aretaeus, anatomy at length has set before our eyes. For to omit the examples of this vein being ruptured in the belly, to which I am uncertain whether the case that Donatus points out in Amatus Lusitanus, in whose writings I have not found it, refers; Laurentius, Hacquinettus, Puerarius, Lancisi, and others, have seen it in the thorax, and even within the pericardium. But all of them, except the second, whose observation is very lame and imperfect, as far as Bartholin has related it, found it to be joined together with other disorders in the neighbouring parts; the first, with the dilatation of the aorta, and the ventricles of the heart; the fourth, with the dilatation of the aorta only; the third, with

a kind of membranous and fleshy body, which was “the tomentum, as it were, of the varicose veins,” being a little less than the heart, and connected to its auricles, of which body you will read these last, and other circumstances, in this section of the Sepulchretum; in which that history, with some of those just pointed out, is related somewhat more clearly than it had been described in the words of Puerarius, in the eighth section. For I confess that I was less able to learn, in that place, in what manner I should understand these passages, “the vena cava being ruptured, and the blood being effused into the pericardium, and the right ventricle of the heart,” which in the observation of Laurentius, who was unacquainted with the circulation of the blood, is said to have happened on account of “the mouth of the vena cava being ruptured, and all those tricuspidated membranes being lacerated,” by which “a mortal effusion of blood was made into the sinus” of the heart also, on the right side: which, to speak the truth, as he takes notice of in the ventricles only, and that in a very great quantity, and not only does not mention the pericardium, but even does not hint of it; I suspect, but am not sufficiently clear, whether the rupture of the vena cava happened on the internal surface only. But without doubt the ventricles of the heart, by some unlucky fate or other, often create a great deal of trouble in understanding the descriptions of ruptures of the vein. For turn to Poterius also, who proposes as the cause of a sudden death, which he relates, “the rupture of a vein in the ventricle of the heart;” but what vein he means, or where it lies, declare to me if you can. The same author has written, that in some asthmatic persons, “the vena arteriosa has been ruptured in the left ventricle of the heart;” a vessel, which you know, is on the outside of the ventricles, and belongs to the right side, not to the left. Without doubt it is much to be wished, as I believe was done in the Strasburg dissertation, which I have not yet seen, except in review, and which gives an account of the rupture of the dilated sac of the vena cava hereafter, especially when they are quite uncomplicated with other disorders, may take pattern from Lancisi, in his accuracy and perspicuity; not only in setting down all the symptoms that had preceded death,



but also in describing the appearances that offered themselves in dissection. And I heartily wish that the rupture of another considerable vein had been unattended with other disorders, which, as it happened within the thorax, and was the cause of sudden death, ought by no means to be passed over in this place: the observation is very rare, and was communicated to me by that very learned physician, and familiar friend of mine, Heraclito Manfredi, in the year 1718.

29. A woman who had been supposed for a long time to be, and really was, consumptive, was found dead suddenly. The left cavity of the thorax showed the interior part of that lobe of the lungs to be diseased, inasmuch as it contained three or four tubercles, full of pus. In the right cavity, however, the lungs were sound indeed, but there was, at the same time, coagulated blood in that cavity, to the quantity of four pounds. It had been effused from the trunk of the vena sine pari; which, although it had collapsed from that effusion, yet, by reason of the vast distension, had retained so much of its breadth, that it might be well compared with the vena cava. This dilatation extended itself to about the length of a span. And about the middle of that length, a foramen lay open, in the form of an ellipsis. And through this foramen the blood had been extravasated.

30. Now let us return from the varices of the veins, to the aneurism of the great artery, but not to those that are ruptured; for of these we have seen enough already: but such, nevertheless, as are causes of sudden death. Of which take these three instances that have been observed by me.

31. The mother of a family, who was two-and-forty years of age, had lived long in a state of infirm health, and had long been subject to a kind of paroxysm, which appeared in the following manner: on using pretty quick exercise of body, a kind of violent uneasiness came on, within the upper part of the thorax, on the left side, joined with a difficulty of breathing, and a stupor of the left arm: all which symptoms soon remitted when these motions ceased. This woman then, having set out about the middle of October, in the year 1707, from Venice, to go up the continent in a wheel-carriage, and being cheerful in her mind, behold the

same paroxysm returned: with which being seized, and saying that she should die, she actually died on the spot.

The body, being brought back into the city, was examined by me on the following day: the face of it was somewhat livid; the other parts appeared to be quite of a good colour and habit; but the upper parts were somewhat lank and wrinkled. And as, on account of those things already related, I had a suspicion of an aneurism at the curvature of the aorta, the dissection was begun from the thorax. In this cavity was contained a serum, of itself bloody, and in equal quantity on both sides, and not inconsiderable; for it had been observed that no blood had fallen down thither, in making the incision of the thorax. The lungs were sound, except that being cut into, as I saw afterwards, they abounded with too great a quantity of frothy serum. The heart was rather large, very hard, and very strong. The aorta was not a little dilated at the curvature; but in other parts of the trunk, and the larger branches, of a proper width. But internally, wherever you cut into it, it was here and there unequal, and not without compleat bony scales, of a small size; not to mention frequent marks of ossification being begun. And seeing this, I opened the whole trunk, and the larger branches: and in this trunk, from the very origin behind the semilunar valves, which were in some places hard, I observed the disorders that have been described, together with the beginnings of future bone, quite to the iliac arteries. Yet through these, and others that are even higher, and in particular the left subclavian, they were not propagated, if you except a part of that other artery, which gives origin to the carotid and subclavian on the right side. Carrying our eyes back from hence to the heart, and to the other vessels that are annexed to it, we saw no kind of disorder any where, except that the trunk of the pulmonary vein seemed to be somewhat larger than it naturally is. In this, and in the adjoining ventricle, was a small quantity of blood, which, like the blood in all other parts of the body, was black, and altogether fluid. But in the trunk of the pulmonary artery was no small quantity of blood; notwithstanding in the right ventricle, and its auricle, there was none; without doubt, because it had flowed down

through the vena cava, which had been previously cut into a little below the liver.

And in examining the viscera of the belly, we made the following observations. The small intestines were mostly somewhat red, and a little livid. The stomach was in a manner double, by reason of the antrum pylori being in some measure divided from the other part, by a kind of constriction; but in other respects sound. The liver was extended very far to the left, and on the right edge of it; and on the lobe which was continued from that edge, it was of a more saturated colour for some space, both within and without, and rather hard. The pancreas was also very hard; and on the side which lay near the spleen, of a red and blackish colour, from the blood that stagnated in it. But the spleen was lax; so that it could easily be broken down with the fingers. The testes were contracted. The osculum uteri was dilated, and subsiding: and the upper part of its fundus was tinged, externally, of the same colour with that which I said the small intestines were tinged with; and not without a disagreeable smell. And there was in the pelvis of the abdomen a serum of the same kind with that in the thorax, but in small quantity. The other parts had nothing worthy of observation. The head I did not touch, for it was already late at night, and the woman died while she was speaking, as I said before.

32. Although you will read, in this section of the *Sepulchretum*, the thirty-fifth observation, which has this title prevised to it, "Sudden death in a man in whom the stomach seemed to be drawn together, as it were, with a bandage;" yet if the appearance, as I suppose, was like that which I have just now described, it ought to be accounted for from the original formation of the part, rather than from any adventitious disease; nor ought by any means to be compared with those firm coarctations of the small intestines, which have sometimes occurred in a *volvulus*, and still less be looked upon as the cause of a sudden and unexpected death. Without doubt, that woman, in whom I have already described to you a stomach of the same kind, was gradually carried off, and by a slow disease: nor have others died suddenly, in whom I shall perhaps describe the same circumstance in other places. But here we have causes enough in the

diseases of the artery. In the first place, the inequality of the internal surface renders the motion of the blood less easy. And, secondly, the bony scales in the coats, and the frequent beginning ossifications that were seen up and down, make the artery less fit to yield outwardly to the impulse of the blood, and admit it; and less fit, likewise, promptly to restore itself soon after by contracting, and thus push forward the fluids. Finally, the dilatation of the curvature being added to these, helped forwards their effects; and that, not only by delaying the blood's motion, but also by propelling it with less force than usual, as I have already explained, with the other circumstances, on more occasions than one; so that there is no necessity of repeating these explanations at large.

Taking these effects for granted, then, if from any cause whatever, a quickened motion of the body, and consequently, a quickened motion of the blood, is brought on; you see very plainly, that the aorta, which was scarcely equal to that office before, must be now still more unequal to the task of dispatching on the blood with greater quickness. In the mean while, therefore, a more plentiful quantity of blood, that has been brought together by the veins, will be heaped up; and stagnating in the aorta itself, in the heart, in the vessels of the lungs, and the vena cava, will not only be able to bring on those symptoms that the woman had when living; the violent uneasiness, the difficulty of breathing, the numbness of the arm; or what were observed in the body after death; that is, some dilatation of the trunk of the pulmonary vein, and the great effusion of serum into the bronchia and the cavities of the thorax; will not only, I say, be able to produce these effects, but even more in number, and more violent ones, according to the disposition of the parts. And as all those disorders of the aorta were encreased, gradually indeed, but more and more every day; it is not to be wondered at, if they should at length proceed so far, the quantity and turgescency of the blood being, perhaps, at the same time increased, or at least the motion of it being quickened by the motion of the carriage, which was unusual to a Venetian woman, that the blood stagnating, could no longer be propelled.

But if you are not satisfied with all these causes, one of which

only, that is, the bony scales in the aorta, gave satisfaction to the very ingenious man with whom I dissected that woman, that is, to Santorini, as I shall shew in the latter end of this letter; or if you are not satisfied with them, because we did not find the aorta, and the left ventricle of the heart, filled with stagnating blood; or because you think that you can better conceive of that numbness in the arm from supposing some convulsion with which the meninges were contracted about their origins, than from supposing the distraction of the distended aorta to have been propagated to the left subclavian, and to the nerves that lie near it; I am so far from replying any thing to your objections, that I shall rather advise you, if you choose to add a convulsion to the other causes, to allow of it principally in the heart. Indeed, this viscus must, without doubt, have been very strong naturally, when compared with the aorta; and for that reason, according to the dogma of Lancisi, must have weakened and overcome it: but tell me, I beg of you, why after labouring so long in supplying the place of those very powers of the aorta which itself had destroyed, we not only found it very strong, but very hard also? Read over again what I wrote of a certain man in the former letter. And a convulsion of the viscera arises much more easily in women, particularly in valetudinarian women; so that we may add this to the number of other causes both of the paroxysms and death; yet so as not to forget those things that manifestly occur in the viscera and the principal vessels; nor yet to imagine that this is to be added to the others, as is the custom with many, except when there are marks of it also in the living body, or in the body after death. And whether this should be done in the old man whose history I shall immediately relate, you yourself will judge.

33. This old man was, to appearance, about sixty years of age, and had three months before been in this hospital, complaining of a difficulty of breathing, and spitting up an ill conditioned matter. Having been in the country lately, about the beginning of March, in the year 1742, and having been exposed to a cold wind, upon his return home again, he was seized in the night with a very great difficulty of breathing. Wherefore, being

brought into the same hospital again, in the morning, and sitting a little time by the fire-side, while they were warming his bed, he had scarcely laid himself down therein, but he instantly died. The students begged of me, on the following day, that I would enquire into the cause of so sudden and unexpected a death. And having consented, I ordered the cranium to be sawed round in the mean while, in order to be ready against I came.

As I looked upon the body, which was of a good habit, no tumour discovering itself any where, except that the face was somewhat swelled and reddish; and the blood being looked upon at the same time, which had come from within the cranium as it was cut through, almost in the quantity of a pound; although I did not deny but it might happen, that the cause of death should lie hid within the cranium, yet I shewed, that it seemed to me, we should rather enquire after it in the thorax, as it was certain that this man had laboured under a difficulty of breathing; but whether he had laboured under any disorder of the head, did not appear: in which part although a great quantity of blood generally stagnates, in those who are suffocated from a disorder of the thorax, as is perceived from the face of these persons being livid and swelled; yet the chief cause of death is not for that reason supposed to be on the outside of the thorax.

The thorax, therefore, being immediately cut into, and the sternum being taken away, the lungs appeared to be so turgid as to fill up the whole cavities: they were nevertheless soft, of a white mixed with a cineritious colour, and light, as we afterwards perceived, by taking them out of the thorax together with the other parts. For the right lobe was previously to be loosened from the pleura, to which it adhered closely, especially on its upper, and even on its posterior, surface. There was, in both cavities of the thorax, a considerable quantity of water, not turbid, but the colour of urine; which kind of water, also, was found in the pericardium in somewhat larger quantity than it is generally. In the right ventricle of the heart I found a very black and almost fluid blood, as I did in some other places here and there; so that only some grumous coagula appeared, which were not very firm, together with some slight and small beginnings of

polypous concretions. In that ventricle, and the adjoining auricle, I could meet with nothing that was preternatural; if you except the valves that lie at the beginning of the pulmonary artery, which seemed to be somewhat thicker than they naturally are. But, although the left auricle, and the trunk of the pulmonary vein that lies near it, were in their natural state, the ventricle adjoining to them, nevertheless, although of its usual thickness in the parietes, seemed to be wider than natural, and the mitral valves to be hard and thick; and all the semilunar valves had their edges hard, white, and, what is more than all the rest, become so much thickened as to equal a line and a half of the inch of Bologna in thickness.

Moreover, the trunk of the great artery was much dilated from those valves quite to the upper vessels; and beyond these was still dilated, although in a less degree; the parietes of it being thickened, and grown much harder besides, from the heart quite to that part; and the internal surface being here and there unequal, and especially where there was a more considerable dilatation; nor was it without white and yellowish beginnings of future ossifications, in great number.

After this, I examined the lungs very closely, but could make no farther discoveries than I had done before, except that there was one part in which they seemed to be a little hard: this, however, when cut into, shewed a natural structure, which contained a white and frothy humour, but not any different humour, or in any greater quantity, than you might press out from the other parts of them; and from every part a small quantity only was pressed out. Finally, the upper part of the cranium being taken away, (for we did not dissect the belly) and the dura mater being soon after cut through, the falciform process of which seemed to be very thick and hard, there was nothing found worthy of remark within the cerebrum, or cerebellum, the substance whereof was firm, except that there was no very small quantity of water in the lateral ventricles, similar to that which is described in the thorax, and the plexus choroides were somewhat discoloured; so as to make it evident that the blood, which had flowed down from the cranium, when cut through, had proceeded from the

vessels of the meninges, which were injured by the saw, mixed together, perhaps, with water which was within them.

34. What the internal inequality of the aorta, what the hardness of its coats, what the dilatation, in fine, may contribute, by way of impediment to the motion of the blood, has been sufficiently taken notice of in the remarks that have been subjoined to the foregoing history. To these, which were in the old man also, add some dilatation of the left ventricle of the heart; add the thickness of the sigmoid and mitral valves, and their hardness; add, in particular, the borders of the semilunar valves being so much thicker and harder than in their natural state, which is a circumstance that disturbs the motion of the heart and blood, if any thing else does, while they either oppose themselves to the blood that is about to go out from the heart, and break the force of the motion received from the heart, or do not sufficiently, by reason of their not unfolding themselves so speedily as usual, prevent the blood flowing back in the contraction of the artery; and you certainly will not want more circumstances to make you conceive how it happened that the motion of the blood through the aorta and the left ventricle, being retarded, a difficulty of breathing was brought on by the blood being retained in the lungs; or how it at length came about that these disorders being encreased every day, the whole constitution was affected to such a degree, that the blood, especially when augmented in its quantity, by that addition of moisture, which, if it had not been obstructed by a cold wind, would have passed off by the invisible foramina of the skin; that the blood, I say, could no longer be circulated.

Nor would I have you be much surprized, that in this, and in the former observation, we did not find the blood accumulated in those parts, in which I have said it was retarded. For nothing happens more easily, while the bodies are turned about on every side, and while they are carried from one place to another, and particularly up stairs, where, sometimes their heads, and sometimes their feet, are turned downwards, than that the blood, especially when fluid, as it was in these bodies, in great measure changes its place: and the same must of course happen when the



viscera are taken out; and indeed the blood must then flow down through the vessels that are already cut into, and afterwards through those that are opened in the neighbouring parts. But if you should be willing, nevertheless, to attribute something to that water also, which was seen in the ventricles of the brain, and to suppose any circumstance from whence the nerves that go to the heart and the lungs have encreased the causes of sudden death, and so by this means also explain that tumour of the putrescent lungs, by supposing that they were not able to thrust out their air; I shall not greatly oppose your opinion. But shall you imagine that there was something paralytic, or rather something convulsive, in that man whom I shall immediately describe to you?

35. A man of some family and credit (who was not yet sixty years of age, having been formerly affected with a lues venerea, so that the rheumatic pains with which he was much troubled, were also, for the most part, ascribed to that cause, after having got rid of these for fourteen or fifteen years, by means of sweats being excited, with the usual decoctions of woods, and the dry bain) grew fat, yet not immoderately, and particularly in his belly and thorax, but not so in his lower limbs. His intimate acquaintance had observed him to be subject, at intervals, to a cough, with which he expectorated nothing; and in like manner, to a certain difficulty of breathing, especially after eating. However, at a time that he was very robust, and seemed to everybody to be in excellent health, except that he had said, not long before to a friend, that his head was confused; having supped very sparingly, he was first seized with a slight cough, which soon after encreased so much, that being already foaming at his mouth, he ordered a physician to be called. The physician, however, found him dead, the foam discovering itself at his mouth and his nostrils, from whence they said that something of a bloody humour also had afterwards proceeded. The death of this man happened in the beginning of May, in the year 1729, in which month it is hinted in this letter, and in others, and particularly in the third and the fourth, that many had died suddenly in the city, and in the country round about it: and if you compare the

dissections of these persons one with another, you will readily conceive, that notwithstanding all of them were taken off by an unexpected death, yet that different persons were taken off from different causes, as this man, whose thorax and internal parts of the head I examined, together with the primary professors, my colleagues, about thirty hours after death, and made these observations.

The thorax, which was on its sides of a livid and reddish colour, had a considerable quantity of fat on its external part; and when it was opened, we also found a considerable quantity in the mediastinum. The lungs were internally and externally brown, and yet soft, both lobes being connected with the pleura anteriorly, but the left all round; and internally, they were found to be moist, but not to any very considerable degree; so that they were neither externally heavy, nor did they discharge a froth, or any thing else, from the *aspera arteria*.

In both the cavities of the thorax and in the pericardium was a much greater quantity of moisture than there usually is; which was of itself of a bloody colour, and not so from the blood that had fallen down in the dissection. The heart and its auricles not only contained nothing polypous, no appearance of which kind I saw any where in this body, but even contained scarcely any blood. As in this subject I could find nothing worthy of remark, in the valves, or in the great vessels, each of which I ordered to be laid open, except in the aorta; I at length fixed my attention to this vessel. For, in the first place, from the heart quite to the curvature it seemed to be dilated. It was also marked, here and there, on the internal surface, with white spots. And it was, besides, on the same surface, universally unequal in some measure. And what seemed to me the most remarkable of all, of a black colour mixed with red, as if it had been affected with a kind of inflammation. These white spots did not appear beyond the bounds of the dilated artery. But those other affections were produced through the curvature, and where the artery goes down in the course of the *vertebrae*; yet not so much as in the dilated tract. So also, although they were produced through that branch, which sends off the *subclavian* and the *carotid* on

the right side, yet the greater distance this artery obtained from the beginning of it, the less did these diseased appearances discover themselves. Having begun the dissection of the head immediately (the face being then livid) when the cranium was opened, nothing at all flowed out. The vessels of the pia mater were turgid with blood; and in the lateral ventricles we observed a water which was somewhat bloody, though not so to any considerable degree. However, the colour of the plexus choroides, and all the parts of the ventricles, or those in the medulla oblongata, the cerebrum, or the cerebellum, which were rather hard than lax, that are wont to be enquired into by dissection, were all in a natural state. The abdomen was not opened.

36. If you should say that this man was suffocated by a convulsive cough, I shall be so far from contesting it with you, as I know that the invisible cause thereof might lie hid in some nervous ganglion, that I will put you in mind over and above of the examples which are in Lancisi, of a convulsive cough that has suddenly carried men off. Yet I do not, for this reason, think that those appearances which I observed in the great artery, are entirely to be overlooked by you. For this man had, indeed, been subject to a cough; but one which was not wont to attack him with such violence, that it could, as in the examples of Lancisi, be foreseen and foretold that he would some time or other be suffocated thereby.

We must consider, therefore, what assistance the inflammation of the aorta may lend, to the bringing on of a sudden death; whether joined with a cough and convulsion, or not joined therewith. Yet we must previously consider, what things have been observed by others, when there was an inflammation of the aorta; lest our speculations should, perhaps, lead us so far as not to agree with observation and experience. But when you have examined the passages of Aretaeus, in which this disease is treated of, though there should be no other cause of doubt, yet this at least will occur; I mean, whether those signs which he produces, are confirmed from the inspection of bodies after death. But I do not at present recollect, that any one has made this enquiry, from the time of Aretaeus quite to our times. I only

remember that Boerhaave says of an ox, who had run away with a most violent impetus, that he had seen this disorder in such a degree in this creature, that the "aorta" was "extremely black." If you should see other things said by him, or others, on this subject, I would have you put me in mind of them: and when I have read them, I will either reject my present speculations, or if it is in my power to confirm them I will write them to you.

In the mean while, I will not omit to add some other certain instances, that have been observed, by my friends, in the great artery, or in any other within the thorax, from whence either a sudden, or, at least, a speedy death, contrary to expectation, has been brought on: and first, what I promised above, that is to say, how much the celebrated Santorini believed, that the bony scales in the aorta related thereto; which, in consequence of his own observations, he did not doubt were even of themselves sufficient to kill a man suddenly. For he related to me, and the rest of his friends, six or seven instances of persons who died in this manner, in whose bodies he could find nothing, besides these little bones, from whence to account for their sudden death; and amongst them, the most recent was of that man of whom I made mention in another place, on account of the *appendicula vermiciformis* being deficient. The narration was as follows:

37. A Venetian taylor, who was given to hard drinking, and in regard to whom it was not certain that he had made complaint of any thing in respect to his health; except formerly of a hernia, and that he had very lately said to somebody, that he seemed not to be very well; sitting by the fire, on the very same day that he had said this, at the house of one of his acquaintance, and having eaten two little fish called gurnets, and drank some new wine; for it was now almost the middle of October, in the year 1708; not long after, as he still sat in the same place, he cried out, Oh! oh! and no more; for he was instantly dead.

The thorax being opened on the day following, the lungs, indeed, were not very sound; and in the pericardium was found some quantity of water. But as it was evident that the man could not have died in this manner from either of those causes; and as the heart, and the other viscera, had no appearances worthy of

observation; the great artery was opened, from the curvature quite to the loins; and showed, internally, frequent bony scales; which were seen in both of the carotids also, but not farther than to a moderate height.

However, the blood was fluid, the liver very natural and fine in its appearance, as the other viscera also were, except that the stomach, as generally happens in drinkers, was very large; and that part of the intestines which I have said was without the *appendicula vermiformis*, was in the hernial sac, together with a portion of the annexed mesentery; and the orifice of the sac was three or four inches broad.

38. After he had accurately related these things, and after we had, as is usual among friends, said some one thing, and some another, in regard to the sudden death of this kind he had given us the history of, and even those causes which escape the eyes of anatomists, whether they are on the inside or on the outside of the brain, not being passed over without notice; I remember I asked, with a kind of smile, whether they also placed, in the number of those causes, that which *Piccolhominus* has hinted at, where he says, "it is his opinion, that the obstruction of the little nerve which goes to the heart, suddenly brought on, is the cause for which some persons go suddenly and unexpectedly out of this world?" At least, said I, you are not ignorant, that even when the nerves, which are about to go to the heart, are cut through in the neck, the animal does not immediately die; so that although an obstruction of the nerve going to the heart may, possibly, when joined with other causes, bring on a sudden death, yet it cannot of itself have that effect, unless all of them should be obstructed at the same time: for by this means I understand the justness of the opinion of *Herophylus*; who, as we have it in *Coelius Aurelianus*, taught, "that sudden death, when it is proceeded from no very evident cause, was brought on by a paralysis of the heart." Then *Santorini* related the other six examples, which were similar to the one already given; and said, that he should very much wonder, if, in all these cases, some invisible cause or other had not been at hand, and had joined itself with a manifest one; that is, with the bony scales in the

aorta: and showed, that in regard to himself, he had not the least doubt, but sudden death had proceeded from these alone; especially at the time when the blood was to be pushed forwards, by an artery affected with a disorder of this kind, while it was just increased in its quantity, by the recent chyle being added to it; or turgid, from the quality of this chyle; or, finally, while it was expanded by heat; which circumstances, without doubt, had all of them coincided in the taylor, and some of them in the others. But why an artery thus diseased was, at that time, unequal to the task of propelling the blood, has been already explained by me; and that even in this letter.

39. But mention being made of my most intimate and esteemed friend calls to my mind the remembrance of another, Sebastian Anthony Trombelli, a most excellent surgeon and physician, at Bologna; whose sudden and unexpected kind of death happens to be the more lamentable to me, for this reason also, that I had a singular regard for his brother John Jerom, the abbot (a most learned divine, as his writings testify) and still have a singular regard for him. You cannot be ignorant how sudden, violent, and short, the last disorder of the former of these gentlemen was; and how many, and various, were the opinions of learned men upon it. If you ask what I myself thought, before I heard any thing of these, I will tell you in a few words, that there is no opinion to be preferred; but that you must accurately enquire, and consider, over and over again, whether it is probable that this disorder has any relation to what I just now premised.

For as soon as ever I had read over the letters of Joseph M. Verlicchi, (whose diligence, assiduity, and continual study, in medical discipline, was well known to me, from the very time that he attended my lectures here) in which he not only gave a full account of all the appearances that he had observed in the body, which he dissected after death, but also of what had been observed in the patient, whom he had attended; the case seemed to me to be, in some measure, comparable with that which was described by a very learned man, whose too early death I have likewise lamented, Anthony Leprotti: and this I wrote back to Verlicchi; and found by other letters, which he sent to me after-

wards, wherein every circumstance was clearly explained, that his opinion agreed exactly with mine. That is to say, as in the man of whom Leprotti gives the relation; it was found by him, and the celebrated Janus Plancus, that blood being extravasated from the bronchial artery, which was ruptured, under the membranes, and through the interstices of the fibres, by which the asper arteria, the aorta, and the oesophagus, and the other neighbouring parts, are collected together, had made a passage for itself, to a considerable extent, all round; and being coagulated, had raised these membranes into the form of a tumour: so in Trombelli blood being extravasated from some other artery, that was ruptured betwixt the opposite laminae, that is of the anterior part of the mediastinum, seems to have opened a passage for itself through the cellular substance of that part; and to have coagulated in such a quantity in that place, in particular, where it was carried by its own weight, that, near the diaphragm, the solid thickness of the mediastinum was almost equal to three inches. And by this means, all the circumstances which had preceded, and those that did not attend, as well as the appearances which were found in the body, seem to be very easy to be understood.

And although, as I have promised to be brief, I must not consider every one of these circumstances separately, yet I will say, at least, that those corpuscles which had before corroded the skin, in the form of a very large and troublesome herpes, did, when this eruption was driven back, corrode that artery; and that the blood which issued from the artery, while it drew asunder the laminae of the mediastinum in a speedy and violent manner, had been the cause of that very severe pain in the sternum, which the patient described to be of such a kind that it seemed to be tearing him asunder; but that it ought not to have produced the other marks of an inflamed mediastinum, which were absent; and, at length, that such a great quantity of blood as was collected into grumous concretions between the two laminae of this part, especially in so short a time, could not be accounted for but from some artery being pierced through.

However, most of these things the letters of Verlicchi explained;

and not only the others, which also answered the objection of those who, as Leprotti's patient had dragged on his life for some days, enquired into the reason why Trombelli was taken off within nineteen hours. For besides that the heart was pressed upon by so very great a distension of the lower part of the mediastinum, a tubercle had been formed before this disease, at a small distance above the heart, in the coats of the great artery, of the bigness of a pretty large nut, full of a humour verging to the colour of the yolk of an egg; which tubercle being protuberant to a considerable degree within the cavity of the artery, the blood was not able any longer to overcome that obstacle as before, the powers of the heart being weakened, as appeared from the pulse being become small and weak; but being retarded in its motion more and more, oppressed the heart and the lungs themselves: for which reason the force of the disease could no longer be supported.

40. You have heard, then, which way my opinion of this disease formerly inclined; whereto, however, you will pay no greater respect than accurately to consider of it. And if you ask what marks of the existence of this tubercle there had been in the living body, and whether I have ever read any observations, besides that I just now commended, in which there are circumstances, in some measure at least, similar to those that were found in Trombelli; I will satisfy you as far as it is in my power. And, first, I have heard that he had been formerly oppressed with very heavy passions of the mind, and later than that with some slight palpitation of the heart; and that he also began to be attacked with some little faintings, so as to be thought hypochondriac by the physicians.

And as to what relates to the tubercle of the aorta, as I find from the *Acta Eruditorum Lipsiensia*, that a dissertation of the celebrated Stentzelius, entitled, "Of steatomata found in the beginning of the aorta," had been published, which has not, that I know of, been as yet imported into this country, I would have you examine it, if it be in yours; for if it answers to its title, you will certainly find some things that are not altogether unlike what you enquire after. If I have any thing which relates to



internal tubercles of the arteries, I shall take notice of it in the next letter. But in regard to blood being extravasated within the laminae of the mediastinum, as far as I remember at present, Riverius is the only one that has hinted any thing in respect thereto, and that in the sixtieth observation of the first century. For as to Blancard's writing something of the same kind likewise, without doubt, they are so far similar as to be quite the same, the name of Riverius only being concealed, and the words somewhat changed. If you read the whole of this observation in its original author; for it is not universally copied in this eleventh section of the Sepulchretum, nor yet in the first of the first book; you will find that there had been a suspicion of an inflammation of the mediastinum also, among other things, in a certain patient; and that when she seemed to have recovered from this, she was carried off by a sudden death; and that the mediastinum was found "full of bloody serum." However, in regard to extravasations of blood from its vessels, considered in general, not into the great cavities of the body, but into the cellular structure, which is confined under membranes, the opinion of Gilbertus deserves, on the score of its antiquity, to be related. For he, as Nicolaus Florentinus wrote three hundred and fifty years ago, taught, "That the blood which is extravasated by the vena chyli, that is, the vena cava, is not always poured out into the cavity of the belly, but is retained beneath the fat, which surrounds the kidneys and other parts:" and this, as it had been, perhaps, even seen by Gilbertus, is not to be so far rejected, if the rupture of the vena cava is small, as that which is subjoined by Gilbertus in regard to discharging from the bladder, by way of urine, this very blood that has been so retained. The other things that I have promised, you may expect very soon. Farewel.

### BOOK THE THIRD

### OF DISEASES OF THE BELLY

#### LETTER THE THIRTY-SEVENTH

#### TREATS OF THE JAUNDICE, AND OF BILIOUS CALCULI

The morbus regius, or jaundice, is so frequently joined with the disorders of the liver, of which I particularly wrote to you in the

last letter, that in the Sepulchretum, the eighteenth section, which professedly treats of this disease, is with great propriety immediately subjoined to the two sections which treat of those disorders. To the jaundice relates this observation of our Valsalva.

2. A young priest was seized with the jaundice, a little after a kind of perturbation of mind: this disorder was also attended with a pain at the region of the stomach, and a vomiting, by means of which he threw up both his food, and his medicines, frequently. After a day or two, the patient was observed to be unquiet, and in some measure stupid, so as to forget every thing that was related to him. The physician did not observe any fever, till the close of the third day: at which time it discovered itself with great violence, with a delirium, and convulsions of such a nature, that the patient was obliged to gnaw every thing with his teeth, and by his great strugglings almost overcame the strength of those who were about him: besides these, he was troubled with a vomiting of a darkish-coloured matter. In the morning a vein was opened, from whence the blood rushed forth with impetus: the serum of which, when it receded from the coagulating part, tinged a linen rag, that was dipped into it, of a yellow colour. The convulsion ceased: but the patient lay to all appearance asleep, scarcely moved himself, and did but just show that he felt the cupping-glasses which were applied to him. His respiration was almost natural, except that it was sometimes suspirious. He died on the beginning of the fifth day.

The belly being opened, the liver was found to be flaccid, and inclining to a palish colour: in the gall-bladder was a darkish bile. In the stomach was matter of the same kind with what he had thrown up, on the last days of his disorder: on its internal coat, about the left orifice, were a kind of red points, at some little distance from each other. And there were many very small glands, in several places throughout the belly, which were inflamed by stagnating blood.

The thorax being opened, the lungs were tumid with air, and free from connexion with the pleura, if you except some small membranous bands, which had tied the left lobe to the pleura. In the pericardium was a little water. In the ventricles of the heart was concreted blood.

The skull being cut open, and the dura mater being incised, a little quantity of serum issued forth: in the interstices of the sanguiferous vessels, which creep through the dura mater, a kind of gelatinous concretion was observed, but in a very slight degree: the cerebrum was very lax, nor altogether of its natural colour, which perhaps had been depraved by the tincture of the bile. While the spinal marrow was cut through, in the upper part of the vertebral tube, in order to take out the brain, from the external paries of this medulla, a serous matter flowed for a considerable time, as if from a lymphæduct being cut through.

3. What effect passions of the mind may have in bringing on a jaundice, is not only demonstrated by frequent observations, in the practice of medicine, but evidently confirmed by the present. Nor will this be surprising, to those who consider how much the nerves consent with the passions, and how much power the same nerves have, in affecting the sanguiferous, and excretory vessels, and in affecting the internal secretory organ, whatever that may be, and consequently in impeding, and vitiating, the secretions, and excretions, of the humours. Suppose, that in some bodies the hepatic nerves consent most, or if other nerves consent also, yet that the vessels of the liver, and the secretory organ, yield more easily to the action of the nerves; and you will immediately understand why a jaundice arises in them, from the passions of the mind.

Thus in Hoffmann, you will read of a woman, in whom, "as often as ever from a preceding commotion of mind . . . new febrile paroxysms came on, the jaundice immediately returned with all its symptoms." And if you take into the account, certain dispositions of the blood, or of the matter of the bile, which is to be secreted therefrom, or of the other viscera, you will so much the more easily understand the affair, and conceive of the origin of those very violent symptoms, which are sometimes added to a jaundice, and bring on death much sooner than expected. All which circumstances may not only be perceived, in the observation that I have given you of the priest, but may also be illustrated, by examples that are in great measure similar. The first of which was related to me, when I resided at Bologna, for

there it had happened, and that not many years before, by grave and learned men, and confirmed by Valsalva himself, who had been present at the dissection.

4. A very ingenious young man who was set apart for learning, and the priest's office, was greatly terrified by a fierce and violent man, who held a musket to his breast, unexpectedly, and threatened to shoot him. The day after he became icteric, and soon after that delirious so as to know none of his acquaintance, but cried out every now and then, oh vile man! and then being seized with very great convulsive agitations, so that he could scarcely be held by the hands of many persons, he died within four and twenty hours from the beginning of his delirium.

The dissection of his body showed nothing that was worthy of remark, except that the sanguiferous vessels, which creep through the pia mater, were, for the most part, distended with black blood.

5. This history we might have put in the number of those which relate to deliria, or even to convulsions. But because the jaundice appeared first of all the disorders which came on, in consequence of the fright, I chose rather to give it you under this head. The jaundice seems to have been brought on by a contraction of the hepatic nerves: and the matter of the bile being, in great measure, retained in the blood, becoming acrid, and greatly affecting the brain, as in a young man, and a man given to letters, seems to have brought on all the other symptoms.

6. We will not search after other examples, among medical writers, which are to be compared, in many things, with the example of Valsalva, as we have two here in the Sepulchretum, one of Ballonius, in a young man, son of the Count de Chaulney, and another of Guarinoni in the Cardinal Sforza. This latter icteric patient had at first no fever, but what was latent, so that the physicians did not attend to it, till after it became more violent, when being seized with a slight delirium, and afterwards with a fresh increase of fever, with a very great tossing of body, and not long after with two sudden epileptic paroxysms, and, finally, three days before death, being attacked with various convulsions, he was nevertheless carried off gradually, and gently; the liver, and almost all the other parts of the body, being

tinged of a yellow colour, to a very great degree, and the lungs being in the same state, in which they are generally found, in those who have been long excruciated with a difficulty of breathing, at the time of their death.

But the young man, from a lively and good-natured disposition, being made morose, and melancholic, and being suddenly seized with the jaundice, after fifteen days, when no such thing was thought of, gnashed with his teeth, and was convulsed in the night; was in an extasy as it were, and after great howlings and convulsions died: the brain being found in such a state, that the cause of death did not seem to have been there, the lungs being very much diseased, but the liver still more, so that it was *υ'πόχλωρον* as it were; for thus the word ought to be written, and thus it is written by Ballonius, as you will see by looking into his second book of the Epidemics, which is quoted, not in page two hundred and forty four that is pointed out, but in page two hundred and fifty eight; and as this word signifies greenish, or palish, you plainly see that this young man agreed with the priest of Valsalva, in this colour of his liver also. And they all agreed in that stupor of mind, which Ballonius calls a kind of extasy, or trance, Guarinoni *levis desipientia* or a slight suppression of the senses, and Hippocrates, or at least the authors of the *praedictiones*, and *coacae praenotiones*, *μώρωσις*, and have taught to be had "from a jaundice:" interpreters render it by the word *fatuitas*, which signifies a stupidity, or dullness, of the internal senses, who are followed by Zachias, in an observation that confirms this, and is transferred into the Sepulchretum.

But if you enquire, why there was not a furious delirium in all these patients, though there were convulsions, there is no doubt but this may be accounted for, and in some measure from the different age of the patients, the different temperature and disposition of the blood, bile, and viscera. Thus in the cardinal, the blood was fluid, and found without any coagulum in any part, of which kind Boerhaave affirms it to be, in icteric bodies, so that "when taken from a vein it does not coagulate:" but in the priest of Valsalva, it had not only been concreted, when taken away from the vein in a proper vessel, but was also found to be concreted in

the ventricles of the heart; for which reason, the stagnating blood appeared about the stomach, in the form of reddish points, and here and there throughout the belly, like many small glands which were inflamed: and that blood of this nature has been sometimes found by anatomists, in the heart of other icteric patients, the observation of Zachias, which I have already pointed out, and another likewise of Bartholin, which you have here in the Sepulchretum also, sufficiently demonstrate; not to mention here my observation upon the potter, who was in great measure icteric, and whom I have described to you on a former occasion, or another of Valsalva, on that icteric girl, which still more deserves our attention, because, though, except the mucous concretion in the heart, the remaining part of the blood was fluid, yet when exposed to the air it coagulated.

But to this disposition in the blood to concrete, other causes must be added, both in this fluid itself, and in the brain, in order to bring on a delirium. And yet it is of no great importance, if the brain, not even at this time, nor when there were the most violent convulsions, appears to be injured. For that which was the cause of delirium therein, may escape the penetration of the eyes: and from the nerves being irritated, even on the outside of the brain, or from an irritation on the spinal marrow, which we must suppose to have had this effect in that priest, horrible convulsions may arise.

7. However, the brain was not found to be altogether uninjured, in that body, whether you attend to that which was observed in the dissection of the meninges, or even the very colour of the brain, which was not entirely natural, and was readily supposed, by Valsalva, to have received a tincture from the bile. For notwithstanding the substance of the brain is itself found to be yellow, sometimes in this disease, I do not, however, remember to have read many observations, wherein it was so found, perhaps by reason of the extreme smallness of the vessels, which go to the internal substance of the brain, in the first place, and in the second place, perhaps on account of their rarity. And this at least I can say, that some time ago, when I had, according to custom, a great number of heads in the theatre, in order to give

the anatomical description and demonstration of the brain, observing a yellowness of the face, of the skin in other parts, and of the membrana conjunctiva of the eyes, in one of them, I inquired to whom it had belonged, and found that it was the head of a man who had been asthmatic, and jaundiced, and had died the day before: through the external surface of the pia mater, I saw, in several parts, considerable spaces of a yellow colour, inclining to greenish; yet soon after, when the brain was dissected, I found the colour therein to be the same as it naturally is.

Again, when a like occasion was offered afterwards, notwithstanding I found the small quantity of water, in the lateral ventricles of the brain, to be of a yellowish colour, and the plexus choroides somewhat inclined to that colour, and the pineal gland itself, in other respects very short, and pretty hard in its body, and having a small substance adhering to its basis anteriorly, not sandy, nor yellow, but white, and towards its upper part having something in it like blood, or a sanguiferous vessel; I say, notwithstanding I saw this gland inclining from its usual cineritious colour, to an obscure kind of yellow; yet all the remaining parts, for I dissected them, preserved their native colour, so that whatever was medullary, I found to be extremely white. So also here in the Sepulchretum, after a long-continued jaundice, you will see that the substance of the brain was very white; although not only the meninges, and particularly the dura mater, but the cranium also, externally, and, in part, internally likewise, was yellow.

For this disease sometimes tinges the very bones with a yellowness, which, as some assure us, can never be washed out from the sceleton. How yellow the bones were in an icteric foetus, the observation of Kerckringius shows, which you will also read here in the Sepulchretum: nor is it to be wondered at; as, instead of blood, he found a yellow humour like gall, of the same kind with that which was found by Vesalius, in like manner, in Martellus a nobleman of Florence, as you would learn from this same section of the Sepulchretum, if his dissection, which is given imperfectly twice over, were once fully described, as it is in another place.

However in all these places you should read Martellus, instead of Marcellus, which is falsely transcribed: and suppose that Van

Helmont, himself, had lit on observations not unlike these, when in the mesenteric veins of two icteric patients, he saw that appearance, from whence he supposed "an excremental virus, or a yellow and stercoreous cruor, or a yellow liquid excrement, the consequence of a second digestion, which was preternaturally taken up into the veins, and dispersed through the whole body," to be the occasion of the jaundice; whereas it was a bile, which, by reason of its having not been secreted from the blood, in a proper proportion, either on account of its great plenty, or on account of the disease of the liver, as in Martellus, abounds at length, therein, to so great a degree sometimes, that the blood which is taken away, and the urine which is then discharged, appear to be perfectly like each other; and that not only in persons where the disease is to prove fatal, but even frequently in those who are to escape, which happened to them, or, at least, to that icteric patient in whom, as Baglivi relates, "instead of blood, yellow water only, flowed out from the nostrils, and from the cupping-glasses, which were applied to the scarifications," just as we read in Lower of the recovery of that young man, who having had a large effusion of blood from his nostrils, and being well-supported, in the mean while, with broths, began at length to have a fluid discharged from the ruptured vessels, which was more like broth than blood.

8. But among these parts which are observed to be the most easily, and most frequently, tinged with a yellow blood, are the adipose membranes in particular, and those which are called *conjunctivae* in the eyes. Valsalva supposed the fat to be the most prone of all the parts to contract the saffron-like colour, where the serum of the blood is only a little yellow. For he had found the fat to be of this colour, in many who were not affected with the regius morbus, and especially in three bodies, which he dissected almost at the same time, that is to say in a hydrocephalous patient, in a man who had been wounded, and in another who had been carried off by an ardent fever.

But this yellowness is so obvious in the white of the eye, in patients labouring under that disease, that the ancients seem to have been persuaded, thereby, to suppose that all objects appear



yellow to those who have the jaundice, which Hoffman says, is called into question, by our Mercurialis in his *Praelectiones Bononienses*, by which he meant perhaps to say in his *Praelectiones Patavinae*, or rather, in his *Lectiones variae*. For in the writings, having brought the testimonies of Varro, Lucretius, Sextus Empiricus, Cassius the physician, and even of Galen himself, all of which affirm this circumstance, he put in opposition thereto the tacit testimony of other medical writers, who are silent upon the subject, and his own repugnant observation, in a great number of icteric patients. And he might have joined with his own observation, a great number of others, without doubting but he would have of those who should succeed, by much the greatest part, assenting to his doctrine.

At least, even lately, although after Sydenham, Boerhaave also, had written the same as those ancients, that very learned man, Haller, has confessed "that he did not find evident experiments to prove this observation," nor had he read, "that the cornea had been found yellow," in icteric bodies; and that not only a slight change of colour, in the humours of the eye, but a very great one, was required, in order to produce this effect: as, for instance, when from blood being extravasated into the aqueous humour, according to the observation of St. Yves, the light appeared to be red. And, indeed, Boerhaave seems to me, when he asserted this a second time, and produced another observation of his own very much similar to that of St. Yves, to have thought "that a little bile mixing itself with the aqueous humour," might be compared with blood being extravasated therein. But it probably happens, from the extreme smallness of the vessel, going to the humours of the eye, as has also been said of the internal part of the cerebrum, that a tincture of the bile does not often reach thereto.

To me, at least, when I formerly dissected the eyes of an icteric woman, no appearance of yellowness appeared in any of the three humours: nor yet in the tunica cornea: which coat in this body, as in other icterical bodies, and particularly in that potter also, of whom I spoke above, though I examined it accurately, and, at the same time, when there was a great yellowness in the neigh-

bouring tunica adnata, I could never find to have any yellowness in it. Yet it may sometimes happen, though very rarely, that objects appear yellow in this disease, that is to say, if the tunica cornea be universally saturated with bile, and not “then only, which even Mercurialis grants, but also if the humours of the eyes are, at any time, tinged with a very great yellowness;” one or the other of which, or, if you please, both, you may suppose to have taken place, in the two examples, that Hoffman testifies his having seen, in favour of the opinion of the ancients; and in a third, in like manner (for I do not remember to have read any more) which is added by the celebrated Scardona.

9. And there may be in the eyes of some persons either a greater number, or a greater diameter, of the small vessels going to the tunica cornea, and to the humours, and, at the same time, in the blood of these persons, a matter of the bile which is more fit to pervade and tinge these small vessels, whether this depends upon the nature, and properties of that matter, or on its quantity. For we see after it is secreted, and deposited in its vesicle, that it passes more easily through the membranes of this reservoir in some bodies than in others, and, in like manner, that it tinges the contiguous parts in some bodies with a very deep and saturated colour, and in others with a very slight one, or with none at all.

That is to say, the blood, from whence it proceeds, if you choose to express yourself in the words of Willis, which you see produced here in the Sepulchretum, “is too much inclined to a sulphureo-saline dyscrasia,” in some, and in other has “the sulphur too much depressed:” for which reason also, as the former are very prone to the jaundice, so the latter, says he, “are perfectly free from this disease,” as he saw in many cachectic and phlegmatic habits, although “labouring under an obstruction, and induration of the liver, in respect to most of its ducts.” Which hypotheses, however, we must admit with caution, or wait to distinguish the times, and the changes, which the jaundice itself brings on, lest you should be afterwards surprized, when you read, in the same place, the observations of Hildanus, or de Graaf. For the former asserts “that a pituitous and cacochymic patient had, at times, laboured under the jaundice for some years together;”

and de Graaf, that the bile of an icteric body was "entirely serous, and tinged with so slight a yellowness, that the linen rags, which were dipped into it, received scarcely any yellow colour therefrom."

But in regard to the quantity of that matter, the nature of which I have spoken of, it is surprizing how great an abundance thereof may be in some bodies, if to that which the native constitution of the body, the time of the year, foods, and drinks, and other things of that kind, which happen to agree in one effect, have accumulated, another be moreover added; as, for instance, if a fever, if immoderate exercise in the sun, if poison, even that which is introduced into the blood by the bite of a venomous animal, and, finally, if any thing else of that kind, suddenly let loose those particles of sulphur also, which had been more constricted, and depressed, in the blood, and carry them away to the liver, so that there are, now, more bilious particles, than it is possible for this organ to secrete.

There is, besides, another method still more known, by which the matter of the bile may be increased in the blood; as, for instance, when little, or none of that matter, which is in the blood, is separated therefrom, either on account of some disorder of the blood itself, or of the internal secreting organ, or on account of the passage of many branches of the hepatic duct, or of the trunk itself, or of the ductus communis being obstructed. For this being obstructed, although what is already secreted does not return into the blood, as many go on to think, yet fresh bile cannot be sent into the full and distended ducts; and, therefore, as the matter of the bile is not carried away from the blood, in the same proportion as it is increased therein, by the concocted aliments, it must, of course, be augmented more and more every day, and abound.

10. And in this way that I have spoken of, it may be obstructed by more rare or more frequent causes. In the number of the more rare are those which you read here in the *Sepulchretum*; as, for instance, the ductus communis reduced to the narrowness of a capillary vessel, or contracted into itself, like a solid chord, and indurated, or altogether solid and bony, or compressed by some

glands which lie round about it. And to the more frequent causes, in the first place belong convulsions, and the *crispatures* arising from hence, which are propagated quite to the beginnings of the small branches of the hepatic duct, constringing and shutting them up, as they are the narrowest. And though this effect thereof cannot, from the very nature of the cause, fall under the notice of the senses, yet it is so consentaneous to reason, that we may, without any scruple, make use of this hypothesis, to explain those jaundices, which have their origin, either from violent affections of the mind, or from pains.

There are, also, very learned men, who thus explain the jaundice that is brought on by the bite of the viper, from whom I should not dissent, if the intestinal faeces are but white at that time, as the strong constriction of the orifice of the ductus communis, from convulsion, which they suppose, requires: but if they continue to be yellow, and even yellower than usual, I shall then go on to understand and explain the case, in the same manner that I just now told you, before any obstruction of the passages was spoken of.

Moreover, among the more frequent causes, are to be numbered the obstructions happening in the other vessels, as well as in the biliary vessels, though it is my intention, chiefly, to consider the latter in this place, whether the obstruction of these tubes is made by some particles being secreted with the bile, which are grosser and more viscid than they ought to be; or is owing to calculi generated from these, and from the bile, by which the branches of the hepatic duct, or the trunk itself, or the ductus communis, are stuffed up. And I do not say, the cystic duct, for this reason, because the obstruction of this passage is not able, of itself, to impede the passage of the bile from the liver to the intestines; although there have been many in former times, and are some even in ours, who, in spite of the admonition of Wepser, "that a jaundice did not follow the obstruction of the neck of the gall-bladder, unless the ductus communis, also, is obstructed," have themselves supposed that men became jaundiced, not only from a calculus sticking in the cystic duct, but also from a calculus in the cyst.

In regard to which opinion, that you may plainly perceive what is to be thought thereof, whatever remains of this letter (and a great part of it does remain) will turn upon the consideration of bilious calculi; since those things which I have hitherto hinted at may be sufficient for you to attain to most of the other causes of the morbus regius, and, at the same time, to open a way to those things which remain to be said on the subject of bilious calculi, either when within, or on the outside of, the liver.

II. These calculi are generated in the liver, "very frequently," and found in dissections, according to what Platerus asserts in the *Sepulchretum*, and Henenius, who says they are "often so large as would scarcely be credible." To both of whom I will not deny but it might have happened so. But as to what Matthiolus has supposed, in dependence upon certain reasons, that stones are generated "in the liver very frequently, as they are in the kidneys," I confess if I attend to the almost innumerable dissections of the human liver, made by Valsalva, and by me, I cannot readily assent to his opinion. For although both of us have found calculi in many kidneys, it never happened to me to find more than one in the liver formerly: and Valsalva never found one, in all his dissections, that I know of.

But when I say these things, I mean no more than to consider that comparison betwixt the calculi of the kidneys, and the liver, as I am by no means ignorant, even from the *Sepulchretum* itself, by how many eminent men they have been found, or taken notice of, in the liver. For besides those three whom I have mentioned, I see that the names of our Fallopius, Scaligerus, Trincavellius, Dodonaeus, Camenicensus, Peucerus, Blasius, Heerius, Dobrzenikyus, for so his name ought to be written, are produced: to which I could add others, and among these Columbus, Forestus, and Reverhorstius: none of whom, however, has supposed observations of this kind to be frequent. If you examine each of these authors separately, you will, perhaps, be surprized, that except Dodonaeus, Camenicensus, and Dobrzenikyus, there is not one who makes mention of the jaundice in these patients, or even describes the ductus communis as shut up with a calculus, or the liver full of small stones.

But you will cease to wonder, when you attend to this circumstance, that it is not sufficient, in order to shut up all the passage of the bile, that a few and small calculi have been formed in the liver, nor even that large calculi have been formed there, unless they are lodged in such a part as to beset the larger branches of the hepatic duct, and entirely shut them up, either by compressing or obstructing them, which may be also brought about by small and innumerable calculi, "filling" the whole liver "on every side," as Dodonaeus says, not lying at a distance from each other, "in a scattered way," as was seen by Forestus; for when they adhere in all the smaller branches of this duct, they produce the same effect as if they stopped up the trunk itself.

12. But I have said that the passage of the bile is prevented from calculi, either by means of compression, or obstruction. For if any one should say that calculi are sometimes formed in the little glandular bodies of the liver themselves, and that to this class, without doubt, belonged those lesser calculi, which Riedlinus saw "on the external surface of the liver," I should not contest his opinion, although I believe they are more frequently generated in the very branches of the hepatic duct, as those who have very minutely traced them, have found. And as, certainly nothing had happened more frequently to Ruysch, in oxen and sheep, than to find calculi in the *pori biliarii*, so nothing happened "more rarely," than to find these concretions in the "parenchymatous substance of the liver itself;" so that, although he very attentively "dissected away all the fleshy part," in more than a hundred livers, yet he found in one only, a calculus "buried in the parenchymatous substance, and not at all affixed to the *porus biliaris*."

Nor can I suppose, that the ancient observations of Platerus, of hepatic calculi resembling "a tophaceous concretion, ramified in the manner of coral, and hollow internally," are to be referred to any other part, than to the same biliary branches, especially as I read Glisson expressly asserting, that similar observations "of tubuli of so great a length, that if they could but have been taken out in their perfect state, they would, like coral, have resembled a great number of the ramifications of the *porus biliaris*, in one

continued stony series," were made by him on the livers of oxen, and even within the same pore or duct. The branches of which Reverhorst, also, found to be internally beset with a calculous crust, in the body of a man.

Nor have I found calculi, in the human liver, in any other place than in these branches. Nor do I suppose that those stones, which by Columbus, and Camenicens, were supposed to be found in the vena portarum, had any different situation: yet my reasons for thinking thus, although not sufficiently attended to by some authors of eminence, as I have already given them on a former occasion, I shall not repeat here. These calculi, therefore, when at length from tubular bodies, by continual and fresh accretions of similar matter, they are made perfectly solid, as happens in aqueducts, must, without any doubt whatever, occupy the whole passages whereof I have spoken, and prevent the transit of the bile.

13. I have also said this; that calculi of the liver, though large, do not bring on a jaundice, is not to be wondered at, unless they are in such situations as necessarily to obstruct these passages. And I believe that this disease was present, for I cannot now positively affirm it, in a certain man, whose liver had a stone in the center of the concave surface, of the form and magnitude of a pigeon's egg, as an anatomical friend of mine, who had dissected the body, informed me by letter, many years ago. But I do not wonder that this disorder had not been observed in three women, who, although they had a much larger stone, or a greater number of concretions, and more heavy ones, within the membrane of the liver, nevertheless, had them in such a situation, that they seemed to be rather on the outside of the liver, than within its substance: and this was the reason I did not make mention of them above. For that membrane being drawn away from this viscus, by the included weight, and being extended downwards, had formed a sacculus in two of them of the length of a span; for in the third it was described only as a follicle, pendulous downwards.

This last observation is from Benivenius, and is totally different, as you will easily perceive by comparing them, from the second, which is given in the Sepulchretum, from the third

chapter of his book. And a similar observation to his; except that in the sacculus not many calculi were contained, but one large calculus, only, was included, together with a great quantity of glutinous humour, and that the woman never complained of any thing but of a heat in her liver; the observation of Georgius Greselius, is subjoined. And it was in consequence of bearing these examples in my mind, and observing therefrom, that besides the gall-bladder itself being enlarged, another kind of cyst, distended likewise with a fluid, might sometimes hang below the liver, which, although it was entirely preternatural, would, nevertheless resemble this natural cyst; it was in consequence, I say, of reasoning from these examples, that in the case of Laurence Bacchetti, formerly a physician at Padua, the history of whose disease, and dissection, two other learned men have published, since Dominic Militia, I carried myself with so much caution, as not to affirm any thing for certain, though I made no scruple to declare my opinion.

This gentleman had a tumour hanging below the liver, which you immediately felt by applying your hand to the abdomen: it was globular, and moveable, so that you could easily bring it towards the right side, or towards the left, by means of the hand with which you laid hold of it. When different physicians seemed to have different opinions, as you will read in Militia, who declares the several opinions of all; to me, who saw him once after others, this tumour seemed to be the gall-bladder, enlarged by an immoderate distension of fluid, and produced downwards, which I declared to Dominic Sephanelli, a physician, and friend of the patient, who with great politeness attended me home, and very earnestly desired my opinion; yet I made this declaration in such a manner, as to affirm nothing for certain. What I had thus declared was so evidently confirmed by the dissection, that although the declaration might be passed over by some, yet the appearance itself could be concealed by no body.

I had seen the same thing before, and particularly in an old man, from whom I had already described it, in the first of the *Epistolae Anatomicae*. And I remembered to have read of it very frequently, and not only among the ancients, as when Vesa-



lius found, in Martellus, the same cyst, "of the bigness of two fists," or when Fernelius said that it is sometimes distended by exuberant bile, "into a very large size;" but among the more modern authors also, as, for instance, in Zwingerus, who saw it "about six times larger than is natural," but particularly the younger du Verney and Yungius, whose observation of one of a still more monstrous size, is taken notice of by Abraham Vaterus; so that after this I do not think it worth while to point out those which have been since produced, nor yet to inquire how great a cyst was found by Lancisi, which, by reason of its very remarkable length, Pacchioni intended to describe, as he expresses himself in a letter which he wrote to me in the year 1710. Although two observations, which I lately read in the writings of the very illustrious Van Swieten, are by no means to be neglected: the first from those of the illustrious society at Edinburg, who found this cyst to contain eight pounds of bile, and that in a boy not more than twelve years of age; the second made by himself, who, in the body of a woman, found the same cyst to be so distended, as to reach quite to the right os ilium, and this cyst had protuberated, by its own bulk, betwixt this bone, and the lower ribs, even before her very lean carcass was cut into.

But it was also found to be extended, in a Polonian senator, "to so surprizing a degree," that in the living body, "it could be felt by the hands." To return, however, to those things which were published at that time, which was in the year 1732, although I very well remembered them, yet not unmindful of those three observations, that I pointed out in the first place, of a sacculus hanging down from the liver, nor yet of the admonition, in the latter end of the sixth book *de morbis popularibus*, that even good physicians, "not to mention others," are often deceived by "appearances," I was not willing to imitate Baglivi, who, if he were living at present, and should read what is written by our Vallisneri, and Scheffelius, would certainly repent of having written too hastily, and in consequence of attending to some observations, but not to all that it was in his power to attend to, "when you see obstinate jaundices, or those that have been cured, return afresh, you may take it for granted, that these are pro-

duced by a calculus of the gall-bladder, and for this reason you may pronounce them incurable.”

14. But in order to treat of these calculi of the gall-bladder, according to my promise, inasmuch as their situation certainly is on the outside of the liver, let me first observe, that there is so great a number of observations, of these concretions being found in the human body, that the list of those which relate to the calculi of the liver, admits no idea of comparison therewith. And if you inquire after the reason of this difference, you will find more than one, when you attend to the causes which are advanced, for the generation of calculi in the cyst being so frequent.

Our Veslingius has supposed the thickness of the cystic bile, and its very long stagnation in that cavity, by which the meatus cystici, and valvulae, are much streightened, and less passable. And these causes you will find so peculiar to the cyst, that the greater part of them are not, by any means, transferable to the hepatic ducts, and it is surprizing that a very eminent physician, among the more modern, who has acknowledged these very causes of the difference we are speaking of, has not equally observed that they are also common to the cow species; in which, as he there confesses, that hepatic calculi are more frequent, so he ought, at the same time, to have assigned some cause of this difference betwixt the human species, and this species of animals.

But those things, which Veslingius had previously demonstrated, were, in the mean while, illustrated, and enlarged, by others; either by remarking a greater thickness of the bile in some men, and a greater disposition to concretion; or by acknowledging a longer retention than is natural, by reason of the spasmodic crispatures, and constrictions of the cystic duct; or by reason of the power of self-contraction being depraved, and weakened, in the relaxed coats of the vesicle. And this weakness of the coats becomes so much the greater afterwards, in proportion as a greater quantity of bile is retained, just as it happens in the urinary bladder, when from the quantity of retained urine its power of contraction is weakened, and overcome: which is a simile that was not only used formerly by Galen, but has even been used by the younger du Verney in the present age: and from hence

you understand what is, in general, the principal cause of those vast enlargements of the cyst being brought on, which I spoke of just now.

To these causes others were, moreover, added by Abraham Vater, whose name ought not to have been suppressed by those who wrote the same things afterwards. For he, having remarked how difficult it is for the bile to ascend, on account of the declivity of the fund of the cyst, and observed the necessarily slow passage thereof, on account of the obliquity of the duct, judged, from considering both these causes, that the cyst being compressed by the stomach, none but the thinnest, and most fluid, part of the bile was squeezed out, and that the thickest was always left behind, in healthy bodies, which would easily concrete, unless it was presently diluted by a new afflux of hepatic bile, and restored to its former consistence.

But when this fresh afflux is either less than it ought to be, or the bile is secreted in a more viscid state than usual, it does not fully answer the purposes of dilution, and renovation; for which reason the inspissated bile of the cyst more easily degenerates into calculi. And Fernelius had traced out these causes to Vateria, and, in some measure, even to Veslingius, when he asserted that these calculi "had their origin from yellow bile, which having been long retained in its proper receptacle, and not timely evacuated, nor diluted, and renovated, by a new influx, grows hard in a surprizing manner."

15. Since, therefore, in this great infirmity, and intemperance, of human life, so many causes, which must be readily granted, are at hand to favour the production of cystic calculi, there is not the least reason to wonder that they have been so often found, both by the ancients, and by moderns. For after Gentilis and Nicolus, had testified their having seen concretions of this kind, the latter in the gall-bladder, and the former in the meatus thereof, Benivenius, Vesalius, Curtius, Falloppius, Fernelius, Stephanus, Columbus, and Coiterus, to take no notice of authors of less note, produced their observations to the same effect: and from the time that human bodies began to be more frequently dissected, even to this very day, no writer in anatomical, or medi-

cal, matters has had occasion to speak pretty fully of that vesicle, but he has made mention of calculi being seen by him there; so that it is with justice the celebrated professor Fabricius says, that calculi of the gall-bladder have, in general, been more frequently observed than those of the urinary bladder; and it is shown by the illustrious Haller, that they are even to be met with more frequently in some countries.

Wherefore I would not have you be surprized, if I say, that while I write this present letter, I have before my eyes, at least two hundred observations of this kind, nineteen of which are my own; but I would rather have you wonder that I have not read, or do not remember, a great many more. Yet those, of which I have spoken, are not so few in number, but that I may from them venture to answer your inquiry, as to what occurs more frequently, or more rarely, in cystic calculi, and that without seeming to answer too hastily, or rashly. You may make this inquiry first of all, in what kind of bodies they are most frequently found? For Carolus Stephanus has asserted, that they have been seen by him, "chiefly, in women, who were pretty far advanced in life;" and, in this age, Frederick Hoffman has said, "that they are found very rarely in men, who are in the flourishing time of life, but more frequently in old men, and still more frequently in women than in men." The first thing pronounced by Hoffman, therefore, is much more true than the last. For I see in the observations spoken of, that the number of males and females is nearly equal. But although I find old people, promiscuously, of both sexes, to the number of sixty-one, whose ages are particularly pointed out by the observators, I find no more than eight who are said to be young: and among these there is no infant, and but one child; and the least age, among these eight, is that of twelve years, and the greatest nine and twenty.

Without doubt, in a flourishing time of life the juices are thinner, more briskly agitated, and less prone to concretion, than in the decline of life, or as Hoffman particularly saw, than in the less laborious life of very old men, especially, and women. For which reason Haller, whom I have already commended, accounts for "the frequent calculi of the gall-bladder, which he found in

criminals, who had been long confined to prison," from the want of muscular action. And to the same cause, you must refer what the illustrious Van Swieten found to happen in bile, which was not agitated. For, "having left it to putrify in a pure glass vessel, he found calculous coagula in the bottom of the vessel." Yet the middle age, although it is an active season of life, has not juices to be compared with the flourishing prime of our age, for which reason it happens, that this time of life cannot equally resist the injuries of intemperance, and of the passions, to both of which it is still more liable than old age. If you add to this, that a great part of the women in the lower classes of the people, do not lead a very sedentary life: and if you compare all these things with those which are said above, upon the causes that produce calculi of the gall-bladder; you will, of course, easily perceive that the observations are consonant to reason.

16. But if you now inquire, whether Reverhorst has written truly or not, when he has admonished us, that we might remark, in regard to these calculi, "that the younger the body is from whence they are taken, the more pale are they in their colour, that in a middle age they are of a yellow colour, but in a more advanced time of life of a darker yellow, or even almost black," it will be much more easy to give you an answer to this question. For it is not the question, here, what is more frequent, but what is perpetual; so that I can readily affirm, even from inspecting my own observations, that this is too hastily pronounced. For I have found not only blackish, but very black calculi, in many of a middle age likewise: in a young man of five and twenty, and in a old woman of seventy-five (the former of which is the youngest, and the latter the oldest, from whose gall-bladder I have hitherto taken calculi) they were not very different in colour from each other, so that they were neither black in the old woman, nor very pale in the young man, especially if you compare them with one of a cineritious colour, which I found in a woman of sixty years of age within one.

But that you may not depend upon my observations alone, I have, certainly, not read of calculi being found in a younger woman, than that virgin of nineteen, who is described by Bonetus,

in the former book. Yet in her all the stones were "yellow, and resembled bile in their colour." On the contrary, that woman, whose history is accurately described by Cajetan<sup>us</sup> Tacconus, was of an advanced age, that is of sixty-three years, and affected with a black jaundice besides. Nevertheless, all the calculi from her body, "not only inclined to a whitish colour, or dilute saffron hue;" but, notwithstanding they were internally yellow, were furnished with coats that were "white, and shining, and resembled the internal silver surface of mother of pearl."

And, without doubt, the age is not to be so much considered, as the matter of which they are, or have been, made, for they do not always bear the colour of the bile in which they are found; and this colour, according to the various disposition of the blood, or of the organs, may sometimes be, or have been, of a different nature, or the bile may have even hid, under the same colour, particles of a different kind, though at the same time of life, and equally proper to form calculous concretions. Thus Abraham Vater, thus the celebrated Trew, to pass over other observations of my own, and those of different authors, met with them in the manner I am speaking of; for the former "found a calculus, in a very thick and black bile, which was of a colour inclining to white," and the latter, in bile which was of a bright yellow, found a calculus that was, externally, "in great measure white, and brown in other parts, but became very white, by means even of the slightest friction," yet internally, if you excepted "a kind of reddish spot, it was pale," and the former of these appearances was in a man, and the latter in an old man, not in any young man.

17. Nor do they more favour the opinion of Reverhorst who have, in general, affirmed that these calculi "are found to be black, blackish, or brown, for the most part:" although, as I know that the calculi found by our ancestors, and by others, have been frequently of a colour of this kind, so myself also confess, that I have more frequently found them in the former years of my observations, than in the latter; yet a great number of mine, and still a greater number of the observations of others, must of course slip my memory, before I can easily believe that these concretions are "for the most part" found to be of that

colour. Kentmann, as you read in Schenck, writing of these calculi in general, says that they are "all of a colour approaching to yellow, which is, by degrees, changed into a deep yellow, or saffron colour, as they increase in their size," and indeed he soon after produces examples "of a kind of yellowish calculi," and "of a yellow one" being found here by our Falloppius.

But a much greater number of instances are added, in the writings of the same Schenck, of concretions of a different colour. And this must be granted: but then other observations are to be set in opposition thereto, as of Joannes Francus, who saw calculi "of a saffron colour," as of Caesalpinus, who saw them of the same colour, as of Boschus, who found them "of a citron colour," as of Panarolus, and Dobrzensky, who found them "of a yellow colour." Nor indeed are Hoechstetter, Schelhammer, Steinius, and Bierlingius, to be passed over, by whom "yellow, yellowish, and saffron coloured calculi" have been seen; nor yet Horstius, nor Helwigius, by both of whom a great number was found; those being all of a "yellowish colour" which were seen by the latter, and, in part, by the former.

To these you may add Platner, and Bezoldus, one of whom found them "of a golden yellow colour," and the other "of a yellow colour inclining to white," and not only these but even many more, among whom are the members of the laudable society at Edinburgh, who found "yellowish calculi," in a boy of twelve years of age, and the celebrated Trew, who saw them "slightly yellow externally," even in the body of a person who had lived more than seventy-four years, and still more the celebrated Haller, as he saw, even in a woman who was said to be more than a hundred years of age, perhaps all the calculi, but, at least, one of them in particular, of a yellow colour. The same author having found sixteen in another old woman, says that thirteen of them were "yellow:" and that in a man who had been hanged, they were of a yellow colour "inclining to white." But Weitbrecht even found them to be "yellow," in an old man.

Other observations, besides these, I have either just now taken notice of, or shall take notice of hereafter: and still others, and those not few in number, I shall purposely pass over; for it is

not my intention to point out them all, but only as many as are sufficient to show, that these gall-stones are not found, "for the most part," of a black or brown colour. And even Vater, Hoffmann, and Bezoldus, when they treated of the colours of these calculi, in general, put among the number of those, which are "commonly," or "more frequently," observed, "the concretions of a yellowish hue," as is the expression of the two first; and Bezoldus has particularly said "that they most frequently incline to yellowness."

18. And although a great number of those who have mentioned cystic calculi, have been silent in regard to their colour, yet there are so many who have not been silent upon this head, that it sufficiently appears they generally are found to be either of a yellow, or a black colour. I say generally, because blue concretions have also been seen, as by Coiterus, Neretius, and Goritzius, who also observed "small red points," perhaps from the particles of the adhering cyst being lacerated here and there: for this calculus was so streightly confined in the cyst, that there was a necessity of extracting it by force: and they have been seen of a red colour, as by Camenicensus, and by Bartholin: of a cineritious, as by our Fabricius and Boscus: of a whitish colour, as by Reverhorst, by Vater, by Haller, by Van Swieten; and even of a silver colour, as by Platerus: of a golden colour, as by the same, and in part by others; for I have not undertaken to mention every one in this place: and finally, of a green or greenish colour, which is much more frequent than those last spoken of, or others which for the sake of brevity are omitted, so that I have very often seen the same, the cineritious sometimes, the golden colour in part now and then, but the others I have never yet seen.

Nevertheless I have also seen calculi of a variegated colour, in the manner I have described them in the epistle sent to Schrockius; and Gerbezius saw them of a brown colour mixed with white; Baeumlinus of a white and yellow, inclining to green; and many others, that were contained even in the same cyst, distinguished with spots of bright red, or scarlet hue, and with others of pale or a grisly colour. Out of which colours, and others that are just now mentioned, you cannot properly call any one



black. And to these you may, moreover, add the calculi which are without, or almost without, any colour: of which kind was that large one found by Scultetus, which not only filled the cyst, but even distended it, and was "pellucid like chrystal;" or those that the royal surgeon Tamponettius, and Manchius, formerly found, the latter "transparent, though friable, and of the bigness of a filbert," and the former "shining and soft like a concremented gum, and of the bigness of a pigeon's egg," (so that it brings to my mind one described by the celebrated Heister, which, beneath a rugous surface, "had a substance, and, in general, a colour, not far unlike a gum, which is somewhat more solid than gum arabic) or that which is represented, in a plate, by Bezoldus, of the form of a chrystal, and perfectly pellucid," found by Henricus Albertus Nicolai, and pointed out in the fifth observation.

That whitish calculus, also, which I have more than once mentioned from Vaterus, was "pellucid and transparent:" to which, if you attend less to the colour, you may add from the Sepulchretum, those thirty found by Scharpius, which were "pellucid like a carbuncle;" and perhaps, likewise, eighty more, which were found by our Sanctorius, "similar to the stones called chrysolites," I suppose like the chrysolites which are described by Pliny, "transparent, and of a golden colour."

But if you would consider nothing besides a shining property, in cystic calculi, others ought to be taken notice of here, as from Griselius that which was a little less than a hen's egg, and when broken, "shone as if it had been full of nitre," or from Jo. Theodore Schenck, and Jo. Rhodius, those which were many degrees less than the last-mentioned, but being broken, in like manner, shone like chrystals "of tartar" or talc, as that also did like "talc," which I first took notice of from Trew: and even to myself, the nucleus of some had appeared to be distinguished here and there, with a kind of shining points. But that those "blue concretions" of Neretius, or Platerus, were shining, the former, at "one time, of a bright silver colour, and at another time, of a bright golden hue," that is externally only; for I do not read that they were broken; has but little reference, I think, to those of which I just now spoke. To which I suppose; these that are described by

Baglivi, may be with more justice supposed to relate; for he says that they "almost emitted sparkles, as if they had been a congeries of black salt chrystallized."

However, to that class certainly belong, chiefly, those two which were not long ago described by the celebrated Morand, one from the observation of the famous Geoffroy, and the other from his own, the former internally in part, but the latter externally, and internally, for the most part, shining, and almost quite pellucid: and to that class belong other calculi described by other authors, and particularly by the very excellent Haller, which I shall more properly take notice of below, when I speak of the structure of gall-stones, not without that "chrystalline" calculus, if I am able in the mean time to find it any where in Hildanus.

19. For now it is necessary, previously, to touch upon a few things in regard to the various magnitude, number, figure, and situation, of these stones. There was a time then, when one of these concretions was not only found to fill, but also to distend, the cyst, as I said just now, and even to distend it "very greatly," as you will see in the Sepulchretum. A calculus has also been found equal to the size of this cyst, of which you will have more than one instance, in the same place. At one time it has been "half as big as an hen's egg," as our Falloppius found it, and at another, as big as a pigeon's egg (for I pass over the intermediate degrees of magnitude in the second and third, as I do in the first and second) of which size they have been seen by many after Coiterus; and amongst these by our Vallisneri, in the last of the Gonzaga family that was duke of Mantua, who supposed it to be an hereditary disease, for this reason, that Bartoletus had likewise found a calculus at the orifice of the cyst, in Ferdinand Gonzaga, who was also a Mantuan nobleman: which would not have been an improbable argument, if this last duke had descended from Ferdinand, who, however, left no sons. But they are generally found to be of a much less size than these: and indeed are, sometimes, so very small, that Vesalius compared those which he found in Martellus, to "millet seeds."

And as the gall-bladder, in this body, was certainly equal to the size of two fists, as I have even said above, and filled with

stones of that kind, you may easily imagine, from hence, how great a number of them is sometimes met with. They who have actually numbered them after Falloppius, who, with that pretty large one, found "a hundred and twenty-three," have reckoned not only "three hundred," as Bartoletus; or "three hundred and six," as the brother of Platerus, more than which I have even found, but above "seven hundred," as Mentzelius, and even "above a thousand," as Graseccius did formerly; so that it is surprizing, that some, speaking in general of the number of cystic calculi, should have stopped at the number of Joach. Camerarius, that is at a hundred and forty-three. And what will you say to an instance, which is already published by the celebrated Storchius, of an ancient nobleman, in whom "more than two thousand of these calculi were reckoned up;" and another, in like manner, by Fascius, who, in the enlarged cyst of a certain man, "found three thousand six hundred and forty-six granules of concremented bile, which he even used to show as a curiosity." And although sometimes there are no more than one calculus, as was demonstrated just now, yet it is much more common to find a greater number.

And as to what relates to the figure, moreover, some of them, indeed, are nearly spherical, some almost oval, or of some other figure, that is not at all angular, as even the likenesses, which are made use of by observators to describe them, demonstrate; as, for instance, that of some species of nut, an olive, an egg, or other things of a similar kind: but they are for the most part angular. And these spherical calculi receive their form from the figure of the vesicle itself, whether this be natural or contracted, or enlarged, and made more globular, by disease, especially when they fill it, and that whether there are no more than one, or more than one, provided they are as yet so soft (for even those that are pretty large, sometimes preserve the softness of new cheese) as to allow of their being all squeezed together into a form of that kind; as you see in the Sepulchretum, that instead of bile, "there was one orbicular stone, consisting of nine other triangular stones, lying mutually upon each other, and easily separable by the hand." A similar observation to which is extant, (except that

it is much more surprizing, on account of the exactly equal partition of weight, and, for that reason, almost incredible) "of a calculous globe weighing two ounces and a half," which, being taken out of a cyst that contained nothing else, "separated into sixty lesser calculi, obscurely yellow, and friable, each of them having five surfaces, and being equal to the weight of one scruple exactly." But other examples of cystic calculi are also extant, which, resembling a pigeon's egg, "seemed to be made up of lesser calculi," or were even "compacted," or "compounded, of mere granules."

Shall we then say that granules of this kind are the first beginnings of cystic calculi? They are certainly often found in the vesicle, for to those which I have here produced, you may add many and many other observations, of the same bodies, as in a virgin spoken of by the younger du Verney, and in a man mentioned by the celebrated Jo. Sebast. Albrechtus, as, in the former, the bile was concreted into so many little grumous corpuscles, and in the latter, was "like granulated sugar, or had the form of "blanched millet seeds:" and not to be too prolix, as in so many other bodies, in which there being calculi "of a granulated surface," or "full of tubercles in the form of a mulberry," the granules seem to have adhered to the surface, and been formed into one substance therewith. It is not to be doubted therefore, but these are the beginnings of those calculi, which consist of granules of concreted bile. But in the cyst, together with the calculi, a great quantity of "sandy and mucous matter, and a large quantity of sand," has been, more than once, found, so that the same person, to whom this occurred, judged "that it was to be considered, without any doubt, as the matrix of the calculi:" and this person was Bergenius. Therefore, if the bile be accreted to a grain of sand, as to a nucleus, you see that this is to be looked upon as another beginning of these calculi. To these add others, which have been observed by me, at other times, and which I shall take notice of with more propriety below; and you will, at once, conceive that granules of concreted bile, cannot possibly be the beginning of every calculus.

But as I have said that these calculi are, for the most part,

angular, perhaps you will ask, from whence I derive the origin of these angles? If many calculi which are as yet soft, and round, are compacted into one, either oval, or spherical, body, in the manner I have described, in two instances just now produced, so that from the compression of one against the other, they acquire these new forms, and after that, from any cause whatever, are separated, it is very easy to conceive of the origin of these angles. Yet because examples of this kind very rarely occur, we generally account for these angles, from the friction of the round calculi, against each other.

For who can deny the existence of this friction; that observes the smoothness of their surfaces, or who looks upon those two cystic calculi, which are delineated in the works of Hildanus? For one of them "is so greatly hollowed out, that it can admit almost a third part of the other," which says he, must have been done, "without doubt, by the continual friction of one against the other; and similar appearances to this, he might have sometimes seen, in calculi of the urinary bladder likewise, from a similar cause.

Consider also that large one, which is described and delineated by the celebrated Bechmann, and which, consisting of three parts, had extended the cyst. When you see how much the middle part, in particular, entered into the lower part, and attend to the exact polish of the surfaces, which were contiguous to each other, you will, beyond a doubt, affirm that this was owing to friction.

20. But with how many angles these calculi have been furnished, of what kind these angles were, or in what manner they were placed, or what figure they, for the most part, have put on, it is not easy to determine from the observations of others, not only on account of the great variety, that there, frequently, is even in those which are contained in one and the same vesicle, but still more, by reason of the proper signification, and strict sense, of words being frequently neglected, in pointing out the figures, by those who ought by no means to have been thus careless, or by the description of those figures being neglected, which were proper to give an idea of their form. Indeed when I read

Vesalius describing eighteen calculi, which he had found in the cyst of a man, "as formed in the manner of a triangle, with the sides and surfaces every where equal;" I seem to myself to have an idea of a tetraedrum properly so called.

But on the other hand, when many others call them "triquetri," or "triangles," or "triangular," I neither know whether they saw them in the form of a prism, or a pyramid, nor, whichever form they saw them in, whether comprehended under equal or unequal planes. On the contrary, however, when Greiselius says that he had found four pretty large "cubic" stones, together with an almost innumerable quantity of other smaller stones, all which, as far as he could distinguish, "resembled a cube;" I have no doubt of his idea: but I am much in doubt, when many others say that they were "square," or "quadrangles," or "quadrangular;" for you see how many different species of parallelopipeds may be signified by these words.

However when I examine, attentively, all the calculi which I have in my possession, and I have a great number, I perceive, in the first place, that it is very difficult to find any perfect regular figure at all, in angular calculi, and I cannot help believing that Vesalius himself, and Greiselius, rather meant to be understood a figure, which approached very near to that of a tetraedra, and to that of a cube: and in the second place, I think that those who have called them triangular, or quadrangular, meant to point out a figure which comes near in some measure to that of a tetraedra, or a cube: and, finally, I suppose that as both of these forms, in consequence of not being perfect, if you so conceive of them, for the most part offer some surfaces to the eye, which, at first sight, seem more like the one, or more like the other, many have referred them to one class, and many also to the other; but if the calculi are examined accurately, in every part, I imagine that they will generally be found of that figure, which was formerly pointed out by me, in the first of the *Epistolae Anatomicae*. And that they have very often more angles than either of these figures requires, that which I there described sufficiently demonstrates: and Kentmannus has formerly taught, that they have many more, and the more in proportion, as there are more calculi contained in a

cyst; however, though I confess that the first supposition does sometimes take place, yet whether the second does I am greatly in doubt; and even if I attend to some observations of Greiselius, and of my own, I know that it is not always true.

But let us suppose what number of angles we please; wherever there are some very acute, or the surface of the calculi is very rough, they may, if a considerable weight is at the same time added, not only irritate the cyst, but sometimes also burst through it. A very extraordinary instance of which rupture you have in the Sepulchretum.

But irritation may excite inflammations, ulcers, and excrescences, which have been seen even by me, and, if with Wepfer, we compare the urinary and gall-bladder to each other, may at least bring on a preternatural thickness of the coats. For the urinary bladder "often becomes four times as thick as it naturally is, by the continual friction of the calculi upon it," as he says, and as we shall see, in its proper place. And he also found the coats of the biliary cyst "preternaturally thickened," and, as he thinks, from the same cause, as others also have sometimes, among whom are not only some of my disciples, but likewise the very learned Trew, who did not find it without a purulent matter, but, in particular, the celebrated Bezoldus, who describes these coats as being "hardened, thickened, and, in a manner, cartilaginous," although he enquires after a different cause from the calculi, which the cyst, in his example, and those just now pointed out, contained; and certainly a different cause may, at other times, with some justice be assigned. But the surface of these concretions is frequently smooth, as Vesalius saw in that lawyer, especially if they are in the number of those that are yellowish, which we perceive, even when dried, to have a kind of greasy smoothness, as if they had been smeared over with soap, an unctuous smoothness of which kind, I have, sometimes, observed to be still more considerable, in those that are of a greenish colour.

21. But as to what I have said of irritation, there is no doubt but this must take place then also, when the calculi are formed within the coats of the cyst, provided they are rough, or large, and thus I suppose that the observation of Gendrotsius, that is

of a dysentery, from a continual discharge of bile into the intestinum duodenum, may be explained, whereas there were two pretty large, and unequal, calculi in the cyst, involved in a peculiar membrane. And you will suppose them to have been generated in the glands of the cyst, and that being increased therein, they had extended their situation between the coats, in which situation those glands, also, naturally lie. For you will remember that small biliary calculi were formerly found, and demonstrated, by me, in those glands which opened by very evident orifices, and were, for that reason, less to be called into question. And that these had been very ingeniously found out, and acknowledged, by the celebrated Galeati also, in an observation very similar to mine, except that those orifices did not appear, I learned afterwards with pleasure, when the first volume of the commentaries of the Academy of Sciences at Bologna was published. And I shall tell you below, that another very small calculus has been observed by me, betwixt the coats of the cyst.

For it is your business, now, to consider, whether in that observation of Greiseliuſ, which I took notice of above, “the other coat that grew to the fund of the cyst, and contained a stone in the form of a cube, that was bigger than any of the others,” is to be accounted for in the same manner. However, I have very little doubt, but the observation of the celebrated Ellerus may be thus explained, which, if I remember rightly I read some years ago, in the fourth volume of the Berlin miscellanies.

For I should readily suppose that the small, round, and yellowish calculus, which he found concreted in the fundus of the cyst, and surrounded with a membrane produced from the pellicles of that bladder, had been formed in some one of its glands. And, indeed, I am also inclined to think it probable, that a calculus, which, from all its appearances, was biliary, had been formed in no other place, as the thicker part of it lay hid in a certain sacculus, betwixt the coats of the cyst, and the other part stopped up the neck of the cyst: so far am I from believing it to be proved by this observation, that the gall-bladder is not furnished with any glands. And, indeed, the cervix of this cyst cannot be stopped up by a hard and thick body of that kind, but other



parts must certainly be pressed upon, which are necessary to the actions of the cyst, or the cyst itself must be contracted, and crisped up, by the irritation; so that we need not be surprized after this, if the secretion of its glands be either obstructed, or injured.

You may imagine me to have said nearly the same things, in regard to the experiments of those gentlemen also, who have tied up the meatus of the cyst, in the living animal. These glands, therefore, are not taken notice of by anatomists, but are known from certain observations, many of which kind are mentioned by me, in the first of the *Epistolae Anatomicae*. In which, however, I have not, taken notice of "some glands that lie very near to the cervix" only; unless, perhaps the learned man supposed, at the time of writing, by a failure of memory, as frequently happens, that what I have there said of the urinary bladder, not under number ninety-six, but under number sixty-three, was said in relation to the gall-bladder.

22. Now since I have said more than I intended of the magnitude of cystic calculi, their number, figure, and situation, although many things, among others, that I have said may be useful in order to distinguish these concretions when they are discharged by stool; let us, at present, go on to consider the remaining marks, which are supposed to be more conducive to this purpose, I mean their structure, lightness, and propensity to take flame.

As to what relates to the structure, from the time in which Kentmannus asserted that these calculi, if you broke them, appeared, internally, to be full of narrow circles surrounding each other mutually, so that any one may observe, or at least, any one who takes the slightest notice, in what manner the viscid, and sluggish bile, had, by degrees, concreted, and become adhesive, "from the center quite to the surface," scarcely any one has risen up, who, speaking of their structure, and mode of accretion, did not agree with Kentmannus. Yet were there some things, which frequently, and in various calculi, ought, in part, to be corrected, by the help of repeated observations, and in part have others added to them.

For as to concentric circles appearing in sections, that may be true in round calculi, whether they are spherical, cylindrical, or

oval, so that the section, in each of these figures, be made according to the perpendicular of the axis, as in the parts of the calculus, also, which are hemispherical, conic, or cylindrical, in their form, as you see, for instance, in the larger of those two represented by Hildanus. But if you divide angular calculi into sections, the external strata, of which they are compacted, must of course be far different from the circular form, and the internal strata, likewise, as far as I have seen, will be nearly of the same kind: and this you may see in the figure which is given you by the celebrated Trew, whom I have often recommended.

For these reasons I imagine they have spoken with more propriety, who, omitting the figure, have only marked out strata lying upon strata, as Boscus, who has said that, out of nine calculi, "layers had been concreted to each other, in every one of them, as they are in an onion;" as Hildanus who has said that his "were concreted in laminae;" and, not to be too prolix, as Malpighi, who has said "that they are made up of a number of involucra, mutually enwrapping each other;" I say, they have spoken with more propriety, than those who, when speaking of angular calculi, have mentioned circles to us, which you will find from the Sepulchretum, was done by Otto Heurnius, where describing a calculus "of a triangular figure, extended into a pyramidal top, he says that cortical circles appeared therein, lying upon each other."

Nor is it sufficient to correct these things in Kentmannus. For among the black calculi, both spherical, and angular, which I have by me, the greater part of them, now, have no strata at all; only some few of the angular, that are the most firm, have an external stratum, but somewhat obscure in its appearance: the remaining substance is of such a kind, that we must pardon the ancient authors, whoever lit upon them, and particularly Piccolhominus, for asserting, that "the bile being burnt in the cyst, like a coal, was converted into blackish calculi," and he even might have said extremely black, with justice, if he had seen these of mine. And I heartily wish the same indulgence could be given to men, in other respects very learned, who, in the great light of this present age, forgetting that, after so many diseases, joined with very great heat, no stones are, generally, found in the gall-

bladder, have imagined that some of these, which happened to be found without any bile, were to be ascribed to a violent fever that had preceded, which, having consumed all the aqueous part of the bile, had converted the remainder into stones.

But it is not sufficient to except these black calculi, in order to reconcile with truth, the other things that Kentmannus has said, I mean that the others are, at least, full either of circles, or strata of a different kind, "from the center quite to the circumference," or as others, in general, say, of all the calculi hitherto known, that they are made up of concentric strata, which descend even to the smallest nucleus. For I would have you see what observations have been made by me in the *Adversaria*, in the *First Epistola Anatomica*, and in the letter sent to Schrockius, on the nature of the nucleus, its softness, and its magnitude in particular, in so many and so various calculi, as I am not willing to repeat them here. You will, at least, perceive that I have found no small quantity of medutullium, in proportion to their bulk, and so much the greater, in proportion as they were more increased, and that full of a soft, and moist bile, and consequently, that no small part of each of them, internally, is so far from consisting of these strata, that it is necessary to enquire, by what means the bile can penetrate inwards, through these strata which are already firm.

You will also perceive other things, that are purposely passed over here, as, for instance, that the cuboidal calculi, which I have cut into, do not consist of smaller calculi of the same figure, but, like the others of which I have spoken, of bile invested round about with strata: that these are of different colours from each other, and sometimes alternately so: and, finally, that they are, not uncommonly, seen to consist of a great number of small lines, going towards the centre.

23. This direction of the lines puts me in mind of a certain structure of these calculi, differing from that which Kentmannus has advanced. Nor has this great number of small lines only, which I just now mentioned, as being observed in each of the strata (and which have certainly been taken notice of by others also before me, as for instance, by Maurice Hoffman, when he

described calculi "made up, of striated laminae, as it were) been sometimes seen, but even still more evident lines, or such as went from the center itself, in one continued course, to the circumference, as by Baeumlinus, who saw, in calculi, which, in regard to the order of the colours, agree, in great measure, as he says, with some described by me, "saline spiculae, as it were," running from the center to the circumference, "in the manner of striae," or lines, so that they seemed to be made up "not so much of lamellae," as of striae.

So Trew, in like manner, asserts that in another calculus, "no lamellated structure could be found, but it rather seemed that radii were running out from the centre, to the circumference, though in an obscure, and confused manner," which the delineation, that is added, confirms. But Maurice Reverhorst, not to omit those who wrote before, when he delineates the sections of one, or two calculi, out of a great number, that he had extracted from the gall-bladder of an old man, in one, indeed, shadows out a kind of cortex, in the form of a circle, but in both represents lines, of no inconsiderable thickness, going, in the manner of radii, from the center, to the periphery. And John Baptist Contulus, having given figures of stones, (such as they are, and like the rest of his performances) found in this cyst, and among them, of one found by him, "which was diaphanous at its extremities," gives a section, as it seems, of another, also, taken from I know not where, in which, indeed, are seen many circular strata, but a much greater number of lines, going from the center, to the circumference.

Moreover, I remember a peculiar species of calculi described by Malpighi, which he supposed to have been formed by concretion, from a kind of mucous substance, that very much resembled soap, or, rather, resembled "camphor," he says, therefore, "that they are of a surprising structure, for that they resemble the lapis judaicus, and are made up, internally, of elegant lamellae, drawn from the circumference to the center, which lamellae are easily separated one from another."

And although he supposed it to have been generated "in the liver, and in the porus biliaris," I believe because he had heard that a stone, which his friend Bonfiliolus preserved, was found

"in the liver" of a nobleman in Germany, yet he could not, for a certainty, know that another of this kind, which he says he had seen, "and which was discharged, together with the intestinal feces, after great pains, and a long jaundice," by a matron with whom he was acquainted, had been generated in the same place. For that some calculi, which have come from the gall-bladder, have been, without doubt, discharged by stool, will be shown below, and that in this cyst also, concretions are sometimes formed, of a structure very similar to that whereof we speak, may not only be conjectured from what has been already said, but will be confirmed immediately, by other observations.

For that transparent calculus of Vater, which is taken notice of above by me, had not only very slender, saline, and shining, striae on its surface, but was also "concreted in the manner of striae:" or if there should be any doubt about this, there certainly would be none in the description, and figures, of those two which I have pointed out from Morand. For both of these have splendid, and pellucid lamellae, the one indeed with strata lying round them, but the other without any, and going, in the manner of radii, from the centre to the circumference. And, lately, the illustrious Haller has proposed others "which were shining like chrystal, and semipellucid," the substance of one of which calculi, that was spontaneously broken, "being almost like selenites, shining, and stretched out from a yellow center, in the manner of radii, to the investing cortex, was made into crusts, and small laminae." The other calculi, which "were smaller, were, likewise, internally laminated, in the manner of selenites, and shining."

24. All these observations, joined with the others, which I have before mentioned, of shining and pellucid gall-stones, will certainly induce you to suspect that many of these calculi, which are discharged by stool, have been too hastily supposed not to have been generated in the cyst, but in the stomach, and intestines, and for this reason, because they seemed to be too far distant from the more general nature, and structure, of cystic calculi. And one in particular which occurs to my mind, on this occasion, is that described by Donatus, from Cornelius Gemma, and which showed, "internally, a substance like the purest glass, or trans-

parent chrystal, with many striae, and radii, jointly running into one center."

It seems, indeed, to be an objection to our suspicion, that this concretion was "very large." But besides that it will be shown below, how much the biliary ducts may be dilated, and even how much they have been found to be dilated, I would have you believe, with Gemma, from the seat of long-continued pain, and tension, in the right *ilium*, under the false ribs, not that it had been concreted in the intestinum caecum, as he imagines, but that being delayed there, in its passage downwards, it had gained a fresh addition of substance, on its external surface, which was partly of a brown, and partly of a black colour, and by this means had grown into that considerable bulk.

So I would have you suppose, that another large calculus, which is described, and delineated, by Bezoldus, had received additional strata in its passage, that were much fewer in number, where "an almost chrystalline nucleus," had been formed, which seems to be very properly represented in the plates, not without some striae being drawn from the center, to the circumference thereof. And the discharge of this calculus, had been preceded by pains of the right hypochondrium, of a much longer continuance: nor does Bezoldus, himself, fail to imagine it possible, that it might have come from the gall-bladder.

In regard to the two observations, of stones discharged from the intestines, which he immediately subjoins, the one large, the other smaller, you will determine as you think most proper. For the first, certainly, points out no seat of the long-continued pain in the belly, and the second says not a word of pain. Yet when you read that a calculus is spoken of in the former, whose "internal shining substance showed mere circles, intersected with striae," and have examined the figures of Schroeckius the father, who was the observer, which agree very well with this description; perhaps you will not suffer even this calculus to escape your suspicion. But in regard to the lesser concretion, of which you will find no more said by the author, Brechtfeld, than by Bezoldus, if you enquire whether, as this calculus, like the three former, and that, moreover, which was seen by Malpighi, was discharged by a

woman, it happened to be discharged by an old woman, as we know was the case in the three former observations; in regard to this lesser concretion, I say, it will perhaps be sufficient for you, that it was "internally whitish, and shining, like chrystal," supposing, that in a very succinct, and close description, the structure might easily be omitted, which, as in other pellucid concretions, also, taken notice of above, would, if the stones had been broken asunder, probably have appeared to be of the same kind, with that described in the last.

But lest you should, perhaps, be liable to indulge your suspicions with too much freedom, call to mind, by way of contrast, the observation of the celebrated Chomel: who found a sacculus, in a decrepid matron, into which the coats of the *intestinum duodenum* had relaxed themselves, containing a considerable number of calculi, of which if you read the description, when examined externally, and, at the same time, know that they were made up, internally, of strata lying round each other, and, pretty near to the center, of striae disposed in the manner of radii, betwixt which, white and shining particles were interposed, you may very easily consider them as biliary concretions. And yet you must of necessity acknowledge, with Chomel, that they were generated in the same intestine, unless you would rather chose to admit one of the hypotheses, which I shall mention: I mean, either that this sacculus had communicated with the *ductus communis choledocus*, where it passes obliquely betwixt the membranes of that intestine, and had received from this meatus, first one calculus, and then others, which had relaxed the membranes by their additional weight; or that the first calculus, immediately upon its detrusion from the duct, and its entrance into the intestine, had, from some cause or other, been detained there, and by overloading the coats, and by forcing them outwards, and downwards, had prepared a sacculus for itself, and the other calculi, which were to come after.

But although you might, perhaps, confirm both explications, the former by the example of the sacculus wherein were the same kind of stones as in the gall-bladder, which sacculus seemed, to the very experienced Galeati, to be in that part, where the *ductus*

communis choledocus had, now, come near to its termination: and the latter by the authority of no other person than Chomel himself, inasmuch as he accounts for the formation of the sacculus, from a calculus generated in the intestinum duodenum, nearly in the same manner as you account for it, from a calculus which had fallen therein: although, I say, you might, perhaps, make use of these arguments, yet I would not have you seem to be too suspicious.

25. And I could wish that those marks, which Reverhorst has supposed to be quite sufficient, to distinguish cystic calculi, from calculi of the intestines, were, at all times, in effect, as sufficient for this purpose, as they are, at sometimes, really useful. His words are: "the proofs of these calculi, that is, whether they really come from the gall-bladder, or not, is that those which are biliary, not only take flame themselves, when applied to the flame, but, also, when thrown into water, by no means sink to the bottom, and even swim upon the surface, by reason of the oily particles of the bile, of which these stones are composed."

However, not to inquire here in regard to other biliary calculi, whether they are to be thus distinguished from cystic concretions; Bidloo, at least, when writing a few years after, "that calculi, arising from bile, swim on the surface of water, and are inflammable by being applied to the fire, of whatever colour, figure, or magnitude, they may be," had immediately added these words, *ut plurimum autem*: which must be supposed to signify that these marks, though general, are not universal, and without exceptions; though, whether this addition has been taken notice of, by any one of all that number, by whom these words of his are either quoted, or referred to, I do not very well know; I confess, however, that I myself have not attended to them, before this time.

Besides, to speak first of their lightness, as I shall speak hereafter of their inflammability; Scheffelus admonishes us, that Reverhorst "is refuted" by Valentine, "not only by a similar calculus not swimming upon water, but also by *aegagropoli*, or globular concretions, found in the intestines of wild-goats, swimming in water, although they are not generated in the gall-



bladder." But I even find that Otto Heurnius has asserted, many years before all these, that three calculi, found by him in the gall-bladder, "had not swam upon the surface of water, when thrown upon it, as many affirm they will, but had subsided." There is no doubt but he had those authors in his eye, whom I have before mentioned, as Fernelius, Riolanus, and others, among whom was, also, Hollerius. Nevertheless, men of the most considerable reputation still continued to follow these authors, and Reverhorst, for a long time, out of whom it is sufficient to have mentioned Ruysch, and Bergerus: nor are some persons wanting still to follow them, as they assert, without any exception, that these calculi all swim in water.

And, indeed, such was the success of the experiments with them: as it was with others, likewise, either at that time, or afterwards, as with Cunradus, Tremelius, Trew, the Edinburghers, and others. But with some the experiments did not at all answer, as with Jo. Conrad. Fabricius, or did not answer wholly, though in part they did answer, as with Lancisi, who saw ten of them "subside in wine and water," which very calculi, nevertheless, "swam in vinegar," as with Weitbrecht, who, in making the experiment upon the same number found, "that if thrown into water, immediately upon their being taken out from the cyst, they were specifically heavier than water, but that when they were dried, they became lighter."

I, however, have first observed some, and afterwards a great number, to sink down in water, resolved to inquire whether these exceptions could be reduced to any certain heads. And I soon perceived, that no exception could be drawn from the colour. I inquired therefore, whether they could be taken from any other property. But it will be easy for you to see, from those observations which I have communicated to Schroeckius, how difficult it must be to determine any thing of this nature, in so great a variety, not only betwixt different calculi, but also betwixt the same, if you only change the time, or any other circumstance. Yet when you have read what I have written on this subject, upon more than one occasion, you will learn some hints, that are useful to prevent us from forming too hasty a judgment of the

situation, in which calculi, that occur to us, have been generated; you will also find some observations, which have been since given almost in the same manner, even by an illustrious physician, whether he had read them in my works or not.

But when you inquire from whence it happens, that some of these calculi swim, and others subside, whether because in the former is a greater quantity, and in the latter, a less quantity, of the oleose particles, which, either by reason of their certain figure, leaving a great number of spaces betwixt each other, or from some different cause, are wont to swim upon water, as we see oils and resins in general do, or because the first mentioned kind of concretions, of whatever matter they consist, have more intervals of this kind interspersed betwixt their component parts, that is, intervals filled up with air, a very great quantity of which, the celebrated Haller makes no scruple to suppose, from the observation of Hales, is actually contained in bilious calculi; I say, when you inquire into this circumstance, then you will, perhaps, not be displeased with the observations, that I have made upon the bubbles which are discharged from, or adhere to, them in water, if they should happen to have any tendency to explain the return, in particular, of those which, having first fallen down, restore themselves again to the surface, or, at least, endeavour to restore themselves.

It will also be of use in your inquiry, to compare my observations with those things, which my friend Stancario has formerly hinted, of bubbles adhering to other immersed bodies, and of their power in raising them up in the circumambient fluid, and which Petit, the physician, has much more copiously prosecuted. In reading of whom, you will likewise learn the effect, which heat, added to the water, will have in causing those bodies, that would otherwise swim, to descend: and this circumstance being transferred to bilious calculi, shows another cause, moreover, from whence the experiments may vary, and would even render these experiments, which I, in general, made in the cold seasons of the year, after the publication of the first *Epistola Anatomica*, liable to suspicion with me, if I had not made them with water just warm, but not hot.

26. But the reason of their inflammability is too obvious to need our present inquiry. Yet I do not remember that any mention was made of this property, before the times of Cortesius, who says, "it is found by experience, that stones generated in the gall-bladder burn like fat." Who after him has affirmed that this property is common to them all, which some even still seem to believe; and who had admonished us that this is true of them "in general" only, was shown you a little while ago. And what various observations I have made upon the burning of different calculi, and what kind I have seen take, cherish, and preserve the flame, and what I have seen do the contrary, is not only said in the *Adversaria*, and in that *Epistola Anatomica*, but also in the latter part of the other letter which I sent to Schroeckius.

From these writings you will learn many things, but this in particular, that those remarks, which are delivered by a certain celebrated writer in medicine, in regard to "all" bilious calculi, even all that are in appearance of a certain nature, are not to be understood to relate to all, upon which I, and others, have made experiments, but to all, upon which he, himself, has made them. There is no doubt but under the same external appearance, a different nature, and number, of component particles may lie hid, in different calculi: nay they sometimes do not lie hid, if you examine them with great accuracy. To that illustrious man Haller, who chose to apply a great number of different calculi to the fire, instead of throwing them into water, it happened, that except those which he calls *calcarious*, all the others took flame, and among those the black ones likewise.

But were these internally black also? At least in describing them to be black, in the second, tenth, and eleventh histories, in the latter, and, in like manner, in the tenth, he mentions, nothing but an "external crust," or nothing but a "shell," which were "black;" and in the second, he says "that when the outer shell was taken off, which was black and thin, a billious yellowness succeeded." You find, therefore, from an accurate description, that the nature of those which were inflammable in his experiments, was different from the nature of others which, being black, not only externally, but internally also, or internally, in

particular, very black, I have said did not take the flame, or when taken, did not preserve it, by which experiments, chiefly, it is made commonly known, that there are some calculi which are not inflammable. And to these I afterwards added others, though not black ones, which, in like manner, had not any inflammable principles; but of these there is no necessity to take notice here.

27. After making so long a discourse upon these calculi, particularly that they may be distinguished from other concretions, when discharged from the body, it becomes proper now, to say something of ascertaining their existence, if possible, when they lie latent within their vesicle, lest you should suppose that I have forgotten what it was that drew me into this long treatise. For it was the reprehension of him, who had pronounced that an obstinate, or returning, jaundice was a "certain" sign of the existence of these calculi, which gave rise to my discourse. But with how much more caution does Fernelius give his opinion, who only says, that we "ought in this case to be suspicious of these calculi;" and yet he laid this down, in particular, if both the cystic ducts, that is the hepaticus, and communis, were obstructed.

But, if even a jaundice of that kind, is no certain sign of gall-stones, it is not easy to say how much those gentlemen have been deceived, who have imagined that they could not exist without a jaundice. And, in order to root out this notion entirely, from the minds of some physicians, where it yet remains, I can with the greatest certainty affirm, that notwithstanding the whole number of bodies, in whose gall-bladders I have found calculi, is nineteen, and the number of which Valsalva found them four, yet not one of all these had been affected with a jaundice. But as three of Valsalva's observations, and as many of mine, relate to letters which I shall hereafter write to you, you may, in the mean while, turn again to those fourteen which I have already sent you, in different letters, and join them with these three that I shall immediately subjoin.

28. A poor old woman had received a violent blow upon her head, by a fall: of which alone were all her complaints as long as she lived; and she lived not a few days, till at length she gradually

sunk away and died. This patient had no inequality of pulse, no traces of a jaundice. And the reason of my making this remark will appear, when I tell you what I observed in the heart, and the gall-bladder, while I was busied in pursuits of quite a different nature. For I did not even dissect the body, that I might know what detriment she had received from her fall.

The body was fat, and yet the skin very hard. In the thorax nothing occurred to me that was worthy of remark; for to some of those who were present, it seemed otherwise, in regard to a polypous concretion, that we found in the right auricle of the heart, which was whitish, and if you attempted to dissolve it with your hand, gave considerable resistance, as if we did not frequently see a crust of this kind lying on the surface of blood, which has been taken from a vein, and coagulated, or, as if this woman had been subject to an inequality of pulse, which they are so fond of attributing to polypi of the heart.

In the belly, the stomach appeared to be almost double, so suddenly was that cavity contracted, before it came to the antrum pylori.

The gall-bladder was half-full of bile, and, being of a bright yellow like orpiment, had tinged all the neighbouring parts with the same colour. In this bile were ten calculi, of an unequal magnitude, among themselves, but none of them small. Other circumstances which relate to them, you will read in the letter to Schroeckius; for this is that woman of whom I there spoke in the third place, showing where, and at what time, I dissected her.

And from thence you may also learn, in like manner, what relates to another woman, the remaining part of whose history I shall immediately add: for it is she who is spoken of, in the first place, in that letter.

29. A woman somewhat younger than the former, yet almost sixty years of age, who was not only far from having an icteric colour, but endowed with a very good complexion, was much given to drinking, and had been seven times married: this woman having complained of no other disorder, but of an inflammation of the thorax, of which she died, was dissected by me, not on account of her disease, but in order to examine into the ab-

dominal viscera, and had some appearances in the genitals, but still more in the gall-bladder, which are not unworthy of being transcribed here.

The uterus had a tubercle externally, on the upper part of its fundus, of the figure, and magnitude, of a small filbert, partly prominent, and partly latent within the substance of the uterus, of a scirrhus hardness, of a white colour, both internally, and externally, and consisting of many different small parts which, in some measure, resembled cells contracted into themselves. And within the cavity of the uterus, from the middle of anterior part of the fundus, rose up a soft, and almost gelatinous excrescence. But although the testes, as was to be supposed from her age, were much shrivelled, and very narrow, yet the cervix uteri, and vagina, appeared differently from what you would have expected in the wife of seven men. For in the latter part, were still a great number of rugae, prominent, even to half the extent of it, longitudinally; and in the former, the figure approaching to that of a virgin-cervix, and the valves, which were preserved on one side, made me suppose, that she had been the mother of very few children, which was also confirmed by the slender rugae, in the lower part of the abdomen.

But as to the gall-bladder, although it was much shorter than in proportion to the magnitude of the liver (which was, in other respects, of its usual sound appearance) for it did not reach, with its fundus, so low as the edge of the liver, but was distant therefrom by almost two inches; it nevertheless contained, together with a small quantity of bile, at least three hundred and thirty calculi, which were chiefly very small, as the shortness of the cyst, that I have described, would of itself argue. As to the other remarks I made upon these calculi, I have said just now, where they may be met with: although in that letter, not only many typographical errors are admitted, but in the part, in particular, to which I refer, more than one whole line is omitted. Besides the great number of calculi which I have mentioned, and which occupied the cavity of the cyst, I discovered one with the knife that lay hid between the coats of this vesicle, which, in the blackness of its colour, and the smallness of its

size, was very much like that that I took notice of above, as having been found in the glands of the cyst, at other times; yet the orifice of the gland was not so evidently laid open here.

30. The body of a very old man, who had been by trade a shoemaker, and who, by reason of his great age, was almost toothless, and had died partly of old age, and partly of a catarrh, within the space of three days, but without a fever, as was said, and certainly without a jaundice, as was manifest from the whiteness of his skin, was brought into the college about the end of January, in the year 1744, when I was teaching anatomy. As the whole of this body therefore, was carefully dissected, I will here relate all the praeternatural appearances which I saw, beginning with those that were observed last of all.

The upper part of the cranium being taken away with difficulty, by reason of the very close adhesion of the dura mater, so that the external lamina of this membrane remained fixed to the os frontis, the cerebrum and cerebellum were both of them found to be pretty soft, and somewhat brown in the medullary substance: the three ventricles of the cerebrum were full of pellucid and pure water: the plexus choroides were pale: the pineal gland was distended into the form and magnitude of a middle-sized grape, by a watry humour, as it seemed: but the glandula pituitaria, if you looked down upon it from above, was contracted, and sunk in its situation. The arteries that run upon the basis of the cerebrum, though they were not distended with blood, like the sanguiferous vessels within the ventricles, but were even empty, appeared nevertheless, both in their trunks and branches, to be wider than they naturally are.

In the cavity of the thorax was a small quantity of turbid and brown water. The lungs were collapsed, and fallen down to the back, in consequence of their being almost quite disjoined from the pleura. As the heart was larger than it naturally is, so the trunk of the aorta was also wider. And the valves prevised to this vessel, at the *aggeres*, as Valsalva called them, were become bony; and even one side of them consisted of a bony scale. But although through the whole trunk of the aorta, on its internal surface, and even the iliac branches of it, a whiteness was much

more frequently propagated, here and there, than bony scales, yet I saw one of these in the curvature, and another near the third pair of lumbar nerves, neither of them very small, and both intercepted, by the internal membrane of the artery on one side, and on the other, by the fleshy annular fibres: and indeed there was a perfect ossification at the division of one iliac artery, into the external, and internal.

Besides, as the trunk of the aorta itself began to bend its course towards the left side, below the emulgents, and return again to the right side, before it gave off the iliacs, so the same kind of disorder, or unusual appearance, was continued into the iliac vessels, to such a degree, that, by their frequent flexions, they nearly resembled the splenic artery. Nor were the carotids, and vertebrae, entirely free from this irregular disposition. And these flexions of the branches prevented me from attributing the incurvation of the trunk, just now described, altogether to the contiguous exostoses of the lumbar vertebrae, the appearance of which was as follows:

Those thick ligaments, that are interposed betwixt the bodies of all these vertebrae, except the lower, were so prominent on their anterior surface, and especially on each side, like an air-bubble, that these prominences, on the right, and on the left side, were almost equal to the breadth of my little finger. All the prominences on the left side, whether because they had begun to be formed before the others, or from what other cause soever, were bony. But of the right, that only seemed to be bony, which corresponded to the interval betwixt the third and fourth vertebrae, yet it was not so; but a bony lamina, that formed the surface of the body of the fourth vertebra, lifted itself above the level of the vertebrae, and in its elevation was also produced upwards, by which means it covered that prominence over with a bony crust: under which crust the nature of the prominent ligament was preserved. When I cut asunder one of the prominences on the left side, with a chisel, and the ligament, that was continued therefrom, with a knife transversely, those concentric lines it is true appeared as usual; but every thing was tinged of a pale and almost cineritious colour.



At length, the other contents of the belly offered the following things that were worthy of observation. The omentum was annexed, on the right side, not only to that part of the intestinum colon, which is nearest to the beginning of it, but also to the small intestines, that lie in the neighbourhood of that part, and to the peritoneum. The stomach was not only more narrow than usual, but even was not a good figure. And the ring of the pylorus was somewhat swelled in two places. Near to the other orifice, a certain roundish, and small kind of gland, was internally prominent, into the cavity of the stomach, which, when cut into, was found to be an encysted tumour; inasmuch as it was made up of a substance that was white, firm, and compacted into one body, of the same figure; but this body could be very easily disjoined from the thin membrane, in which it was contained.

The orifice of the stomach which was nearest to this tumour, that is the *stomachus*, as the ancients called it, was extremely large, as the gula which is continued therefrom was also, to the height of, at least, four inches above the stomach, in the whole of which tract it was more red, internally, than the other parts. And indeed I saw that the foramen, which is opened in the septum transversum, in order to transmit the oesophagus, was much bigger than usual, particularly in its breadth, and that it terminated, at its upper extremity, by a right line transversely, instead of an angle.

When I examined that part of the omentum, which adheres to the stomach, with diligence, I observed, on the left side, not far from the fundus of this viscus, a kind of very small spleen, like a gland, receiving its sanguiferous vessels from the omentum, in which it was, and very much similar to the spleen in its colour, its coat, and the modification of its substance, unless that this last was somewhat more moist than that of the spleen, and of such a figure, and magnitude, that it might be compared with the spleen of a middle-sized hen. Besides this, another spleen was not wanting, which was found, and corresponded with the size of the liver, that was, likewise, found, and of its usual magnitude, or perhaps a little less.

In the gall-bladder, together with a small quantity of viscid

bile, were six or seven calculi of no very small size, the largest of which was not less than a middle sized grape, pretty nearly round in its figure, yet of an unequal surface, as if from other very small calculi adhering to it. If you except some very small points of a yellowish colour, that were scattered up and down, through this surface, they were all, both internally, and externally, even in their very substance. Most of these, after they were dried, fell into fragments spontaneously. And although they, before, seemed to be light, yet those which were thrown into water, immediately sank to the bottom; and those which were applied to the flame, could neither by any means be made to partake of that flame, nor yet be dissolved in any part of them. One of the lesser of these calculi was in that part, where the vesicle begins to contract itself into the duct; yet it had not prevented the discharge of the bile, as we observed by compressing the cyst before we cut into it.

Finally, there being nothing in the kidneys worthy of attention, we opened the urinary bladder, on the posterior surface of which, above the orifice, appeared a kind of white protuberance, like a small inverted pylorus, somewhat larger, in its size, than the seminal caruncle was, to which it extended itself; yet the lower part of that protuberance, being contracted into a low and slender line, was prominent into the beginning of the urethra, and continued to the prostate gland; so that as it was of the same substance of which this gland, consisted, it seemed, beyond a doubt, to every one who was there present, and very much practised in the dissections of these parts, that it was an excrescence of the prostate glands.

31. I heartily wish, as I have remarked all the preternatural appearances, which were in the body of that old man, (for this reason, at least, that nothing should escape you, which, sometimes, may happen to be the occult cause of a considerable disorder) that we were not in the dark as to the effects of them, or the greater part of them, which had preceded in the living body. But it is sufficient, at present, to have known this, that although the gall-bladder contained these calculi, the man had, nevertheless, not been icteric, any more than the women I have before

described, and so many others pointed out above. Which, if it had happened to me only to observe it, I could the more easily forgive those who still hold a contrary opinion, for neglecting, or affecting not to know.

But besides the observations of men of gravity, and authority, which I have produced in a former work, and those of Valsalva, that I have referred to, there are so many others over and above, that I believe it is scarcely possible for me to enumerate them all. Let it be sufficient therefore, to have added some to those formerly taken notice of. Laelius a Fonte says, that in the body of a bishop, who was an old man, "the gall-bladder was found full of light stones, and yet that he had never been attacked with a jaundice." Pechlinus testifies the very same thing of an old woman, and of a woman who was publicly executed at Leipsic, Etmuller, as she had "in her gall-bladder, great plenty of large, and small stones," and our Vallisneri asserts that he had, at one time, found many bilious calculi, and, at another, one large calculus, in the carcasses of many persons who had "never" been affected with a jaundice.

How many cystic calculi Baeumlinus found in that woman, in whom "any thing icteric" had not appeared; how many Fabricius, in a woman who "in all appearance was healthy;" and, finally, how many Haller found in another, who seemed to be "very healthy," and, likewise, in an old woman, in whom were "no signs of jaundice," you may yourself see: nor indeed will you suspect, I suppose, that in a great number of other histories, given by this author, wherein there is no mention of the jaundice, this disorder, probably, might not have been wanting, when you observe that, where he collects the substance of them together, he says, these calculi "were, for the most part, unattended with a jaundice, as was certain from his own experience."

Others, and among these Vaterus, I purposely pass over, since to the authors that I have named, it is necessary not only to add those whom I shall presently bring to bear witness, that they had seen no kind of disorder whatever, joined with these calculi, but those also who, in describing, or making mention of, other symptoms, or disorders, of persons in whom were cystic calculi,

have passed over the jaundice entirely, though a disorder that must have occurred to their eyes, even in spite of themselves: and in the number of these do not imagine there are only Reverhorst, Contulus, Riedlinus, Hoffmann, Bassius, and others of the more modern. Do but turn to the Sepulchretum. You will find Bonetus, Morton, Greiseliu, Kentmannu, Huldreichiu, Cnoffeliu, and others; for I have not time to refer you to every one of them, in particular, in reading of whose histories I could not suffer myself to suppose, that they would so readily have passed over the jaundice, if their patients had been affected therewith.

32. How is it then, you will say, that there are so many witnesses on the other hand, and produced even in the Sepulchretum itself, that have seen this disorder joined with cystic calculi? Not for this reason, certainly, that if these are supposed to exist, the other must necessarily be supposed to exist also. For if so, this disorder must have been seen attending upon those calculi by all. It must therefore be for some other reason. Thus, for the sake of example, and not to depart from the Sepulchretum, you have in the observation of Helwigiu, a jaundice with these calculi, and with a liver, at the same time, lank, shriveled and putrescent: you have them also in the observations of Vesaliu, and Verzascha; but then you have also, at the same time, a liver that was enlarged, hard and green, or scirrhou, yellow, and pallid.

There is, at one time, instead of this kind of diseases another disease, as when Beckerus describes calculi, found not only in the gall-bladder, but in the pori choledoci, in like manner. And at other times there are both of them. Thus Deodatus, and Dobrzenskiu, relate that there was an indurated liver, at the same time that there were calculi, both in the cyst, and in those ducts. And it is not surprizing, that the matter of the bile should remain in the blood, and produce the regius morbus, when the liver can neither secrete it, nor discharge, from its own substance, that which is secreted, without preventing the secretion of the rest. And that to this class also, the old observation ought to be referred, which was taken from the mother of a

professor at Bologna, you would readily perceive, if the whole of it were produced.

You however must read this, as you will that of Vesalius which I just now pointed out, twice over in one and the same section; for it is that very observation (who would at first believe it) which is produced even below: as you will easily find out by comparing one with another, and by comparing them both with that which had been given in another section, or rather with the passages of Coiterus relative to this subject, who is the author that took the observation; for although it is so many times repeated in the *Sepulchretum*, yet the doubt of the author is always neglected, which for many reasons ought not to have been omitted; for he did not say "she had laboured under the jaundice" but "she had, if I am not mistaken, laboured under the jaundice."

You see, therefore, that the testimonies produced are weakened, if any one attends to them rightly, and that their number is, at the same time, diminished, when it is demonstrated that one single testimony is produced twice over, as if it had been a double attestation. Thus you will also find the observation of Timaeus repeated, just as you will that of Guarinoni, and others perhaps: but in none will you be more surprized, than in that of Fontanus, which, having been just before given under number twenty-two, is immediately given over again in every sense, and effect, and indeed almost in the same words, under number twenty-three.

Yet the two last observations relate to quite another class, than that of cystic calculi being joined with the jaundice indeed, but, at the same time, with either a considerable disorder of the liver, or an obstruction of the biliary canals, to which the two former, and some others much more recently published, belong. And one of these, if it be produced, may easily have its testimony lessened in a different manner; as when Vaterus says that a matron, in whose cyst he found thirty calculi, had laboured under the jaundice. For this we confess; but we at the same time attend to what he immediately subjoins, that being freed from the jaundice, she had lived about three and twenty years in a state of perfect health, and was at length carried off by an apoplexy. For if she had been attacked with the jaundice, merely as the

effect of calculi, lying hid in the gall-bladder at that time, she would not have passed so long a space of time as three and twenty years, during which the calculi not only existed, but were even increased, without being troubled with the jaundice.

And an answer of the same kind you will naturally give to them also, who would object the observations of Weitbrecht, and Galeati. For both of them found calculi in the gall-bladder after a jaundice which had long preceded: although you may also give this answer, that by the first the liver was found to be somewhat hard, at the same time; that by the second it was found to be considerably hard, and crowded with a great number of tubercles; to say nothing of those things that I hinted at above, from whence you may perceive, that different calculi may have been formerly in different situations, so as easily to prevent the bile from flowing into the intestines at that time.

But if any one should oppose to these examples, others, in which not only a preceding jaundice, but a present one, was joined with cystic calculi, as those of Lanzonus, du Verney, Van Swieten, Haller, and other celebrated men, you have wherewithal sufficiently to reply, from what has been just now said. For the first saw the liver, at the same time, "beset with a great number of hydatids;" the second so dried up, in one half of its substance, that it did not equal the thickness of a thumb, the third, "pallid, hard, without moisture, . . . and rough with scirrhus tumours;" and the fourth, finally, although in so many histories he only exhibits two of icteric bodies, the second, and the ninth, yet in the former describes the same viscus as being "diseased, and ulcerous," and in the latter, as being "in great measure putrid, the gall-bladder being wholly consumed, so that the calculus was found in the midst of a putrid jelly as it were." And I suspect that if other observations, of some authors, that are produced, had not been made hastily, and by-the-by as it were, but had been taken, and communicated to the public, with great accuracy, it would have happened frequently, that we should read of other marks of disease being found in the neighbouring parts, and particularly in the liver, within which, unless you search after them, they may even lie hid.

Observations that are still less recent, are sometimes produced

likewise; but to confess the truth, to very little effect, as, for instance, that of our Dominic de Marchetts, as if he had said that he had seen a jaundice from cystic calculi. But he, when he says "the vesicle being obstructed by any matter, or by a stone, (for I have sometimes found in this vesicle, three or four stones of the bigness of a vetch) a yellow jaundice is brought on;" says, indeed, that stones had been found there by him; but that he had found them in such a situation as to obstruct the meatus of the vesicle, and for that reason bring on jaundice; he certainly does not say.

33. But setting aside all these, and other similar observations, on account of those animadversions which I have hitherto hinted at, as some still remain to which none of these objections can, perhaps, be made, you will enquire of me, in what manner calculi of the gall-bladder, may sometimes, bring on a jaundice in human bodies, and whether in that manner which Marchettus and others have imagined, if they obstruct the vesicle, or rather the duct which is proper to it, that is the cystic duct.

For that the cyst has been obstructed without a jaundice, is certain even from the observations which I took notice of above for instance, when it was full of stones. And although when it is full of these it can discharge no bile, and consequently it comes just to the same thing, as if the meatus were really shut up; yet to satisfy you I will produce, below, observations of that meatus being stopped up, without a jaundice; but here I will only call to mind what is demonstrated above, that it is not through the ductus cysticus, but through the hepaticus, and communis, that bile is sent from the liver to the intestines; so that unless these passages be obstructed, either by an excrescence, or by some constriction, or by a viscid, and thick matter, or by calculi, generated either in these passages, or in the liver, or even in the cyst, but pushed down into these passages, the bile cannot be retained in the liver, on account of the biliary passages; and therefore the matter, by which this fluid is constantly supplied, cannot be retained in the sanguiferous vessels, in order to bring on a jaundice.

Yet we must be cautious, lest at any time we fall into errors,

in regard to the words which are used by ancient observers, to signify the ductus hepaticus, or communis, and suppose them to mean the cystic duct instead of the other. For they, according to the tenor of the opinions of their times, took either one or the other of these ducts for the meatus of the cyst, as I have even shown before, in explaining a passage of Fernelius; and the cystic duct, as you may see in Mundinus, they called by the name of *collum vesiculae* or neck of the gall-bladder, and not by the name of pore, meatus, or duct.

Therefore, when you read in Donatus, of Albucasis having taught, and Nicolus having confirmed, "that a fleshy excrescence arises in the meatus of the gall-bladder, which, by stopping it up, is the cause of an incurable jaundice," although I have said that this has even been found by me formerly, in the vesicle itself, yet do not be hasty to believe that the excrescence, of which they speak, was supposed, by them, to be formed in this vesicle, or in the cystic duct, inasmuch as it must have stopped up some other passage besides this, in order to have been the real cause of a jaundice.

Thus when Gentilis, as is hinted at above, has asserted that he had found a stone "in the pore, or meatus, of the gall-bladder;" you must consider what you are to understand thereby. The very reading of the Sepulchretum will render you cautious in this respect, where Camenicensus writes thus to Mathiolus: "the meatus which goes from the gall-bladder, and terminating in the intestine, was obstructed by a stone:" and that this was not the ductus cysticus, but the communis, you may be assured not only from what has been said, but also from this circumstance, that in the icteric body in question, "the gall-bladder was extremely full of bile."

Nor will you understand differently, these words in the observation of Coiterus, "in the passage from the gall-bladder, to the duodendum, was a large calculus, which totally obstructed that passage, on all sides," especially when you observe that the folliculus fellis is so described by himself, in another place, that without making any mention of the cystic duct, he says "it is provided with two pores, or passages, one by which it draws bile



from the liver, the other by which it transmits the bile, from itself, into the *intestinum duodendum*." For there is no doubt but he has followed the dogmas of his preceptor Falloppius, in that point, so as to consider the *ductus cysticus* in the manner the ancients did, that is as the neck of the bladder; yet not so far as to acknowledge, that the bile was carried from the liver, to the intestine, by one meatus, and that a strait one, "on which meatus, about the middle of its course, nature has planted a bladder with its neck."

34. It is not the cystic duct, therefore, but the hepatic, which (for though we acknowledge it to be one, yet for the sake of custom, and more clear doctrine only, we divide it into the *hepaticus* and *communis*) I say it is not the cystic, but the hepatic, which we require to be obstructed, either by an excrescence, or by a calculus, which has even been frequently observed there by Falloppius, or by a thick and viscid matter, in some other manner, in order to make us confess, that the jaundice has arisen from the disorder of the more considerable passages of the bile. For that they may be obstructed, not only by viscid, or thick matter, but even by the bile itself, I do not doubt, as I formerly found, in a dog that had been much disordered, the extremity not only of the pancreatic duct, but, also, of the *ductus communis*, shut up by means of a kind of gypseous, and yellowish matter, concreted there: and we read Etmuller describing, in an icteric body at Leipsic, "the lower pore, or meatus, entirely obstructed by a viscid pituita, so that after cutting away this biliary meatus, not so much as a drop of bile flowed out, because the bile, which was contained there, was very thick, and tenacious."

But I know that you may take occasion to interrupt me here, and enquire why then the noble Frenchman, whom Scultetus dissected, as he had "the *porus biliaris*, in that part where it is inserted into the duodenum, so far obstructed with a stone, equal to a large pea in its size, that not the least quantity of bile could be thrown out thereby," had not, nevertheless, been affected with a jaundice? And in so singular a case, unless I should choose to have recourse to those constitutions of the blood, in which the matter that supplies the bile, and even the bile itself, can scarcely give any tinge of yellowness, I am under a necessity of supposing

that there was some peculiar disposition of the biliary passages: such, for instance, as Falloppius asserts had been seen by him, two or three times, that is to say, the ductus communis "divided into a double canal," a little above the intestinum duodenum: which division, but betwixt the coats of the same intestine, "into two considerable branches, that opened by separate orifices, within the intestine," was once seen, likewise, by Abraham Vater.

For supposing one of these orifices to be obstructed, a passage still remains open through the other, for the bile to go to the intestines. There also might be some other more uncommon duct, like that which Veslingius found, and was examined by Bartholin, in a woman "of a good habit, fat, and pretty healthy," when the cyst was stuffed up, and obstructed, by calculi, and which "went from the liver, in the neighbourhood even of the porous biliarius, that was filled up with calculi, and terminated in the intestinum jejunum," or that which Bezoldus describes, as being seen by him, and which, according to the figure he gives of it, is very similar to that of Veslingius, provided it did not go to the ductus communis, but to the intestines, or those that the same author takes notice of as having been demonstrated by Diemerbroeck, which were produced, separately from the ductus communis, betwixt the vesicle and the intestines; so that a great part of the bile might either be carried immediately to the intestines, in a direct passage, or through the more general passage of the ductus communis.

But as to the observations of Andreas a Lacuna, which he immediately subjoins, and which, in part, relate to those observations that I have referred to above, of stones being formed, by concretion, in the cyst, without a jaundice, and, on that account, produced in the first of the *Epistolae Anatomicae*, if he could have read them rather in the words of the author himself, than in those of Riolanus, he would have chosen to make use of the words of the former, in preference to those of the latter, inasmuch as Riolanus, by a slip of his memory, has related three things in three lines, that by no means agree with those which Andreas had said. But let us omit these considerations, and go on to others.

35. As I advanced four kinds of causes above, by which the common, or hepatic, canal may be obstructed, but produced examples of three only, you may perhaps wonder why I have produced no observation of the fourth, that is of constriction. But you will cease to wonder, when, in reading over again the present very prolix letter, you observe this to have been done already, as far as was possible, by examples pointed out from the Sepulchretum. But if you inquire after other instances, from different authors, they are by no means wanting. That is a very famous one, by reason of the eminence of the patient, which was taken from Andrew Mauroceni, a noble Venetian, who was illustrious both as a senator, and as an historian, and which is given us by his learned physician Aurelio Palazzoli. For the cause of the jaundice, of which Mauroceni died, was an insuperable constriction of the passages; inasmuch as "the duct by which the bile is, chiefly, carried to the intestines, had become callous."

Mead, also in a body that had been troubled with an obstinate jaundice, saw the same meatus, where it makes a coalition with the cystic duct, so contracted, as if a ligature had been made upon it, that "it would not admit a probe;" nor could any portion of the bile, with which the gall-bladder and liver were distended, pass on, by this way, to the intestines: and this contraction seemed to have been brought on by a scirrhus, and even a cancerous, tumour of the neighbouring pancreas. And in the acts of the Caesarean Academy, an observation is extant of an icteric body, in which, by reason of a scirrhus pancreas, the same common canal was shut up at its termination, not with "a firm concretion."

Examples of the more rare causes therefore, which, either by condensing the tube into a solid body, or by pressing upon it externally, constringe the common duct of the bile, I have neither been backward to produce above, nor in this place, and should do the same in regard to the more frequent causes of constriction, if the effects of these were as easily observed by the senses, after death, as they are probable from reason, and agreeable therewith. I speak of spasmodic *crispatures*, by which, at least, the orifice of the common duct, or the greater part of the small branches of the hepatic, are constricted: unless we should suppose that the

observation of the celebrated Jo. George Maurerus relates to this subject.

An illustrious man, after a wound received in the region of the liver, which did not penetrate, being seized with a bilious tertian fever, and a jaundice, and after that with other disorders, yet giving hopes of recovery, and in regard to the jaundice itself, being almost quite recovered, but having a violent, repeated, and long uneasiness of mind come on, which a sudden inflammation of the fauces and lungs succeeded, not without "fears, and anxieties, about approaching death," really underwent this change, in the space of three days. And he had, to omit other things, within the cyst, three calculi of a considerable size, but "the orifice of the ductus choledocus, and the whole of this canal, was so far obliterated, or constricted, that it would not allow the least probe, or bodkin, to pass, and much less any drops of bile."

There is no doubt but the cavity of this duct was so constricted, when the skin was yellow, and the intestinal faeces "were white," and discharged "slowly and difficultly." But it certainly was no longer in that constricted state, at the time when the skin was restored "to a quite natural and florid colour," and the faeces were discharged "in a great quantity, and tinged as they naturally are. It may, therefore, seem not absurd to suppose that a spasmodic constriction, which a quiet state of the mind, and a proper regimen of cure, had lately relaxed, returned, within those three days, from new commotions of that kind, together with the whole train of deadly symptoms.

But be this as it will, if you, in the mean time, acknowledge that I have said of crispatures, which are brought on by a spasm, in consequence of certain passions of the mind, or excited by irritations, and pains, of various parts, but particularly of those that are the most near to the liver; I say, if you acknowledge these things to agree with probability, and attend a little to what relates to irritations, you will, doubtless, find out the reason which you asked of me, why, supposing calculi in the gall-bladder, the jaundice may sometimes arise, although there be no other cause, at the same time, of all those which I mentioned above, from whence this disorder could be accounted for.

This was formerly allowed by me, when I said "whether the

calculi found by me, were not yet of that magnitude, or weight, or figure, by which the cyst could be much injured, or whether they were never driven into such a situation, as to have in their power to obstruct the bile," it might have been for these reasons, that in those bodies, wherein I found them, "they had brought on no peculiar disorder, or, at least, none that was evident, and indeed not so much as an icteric colour."

For I did not doubt, but if the cyst were irritated, either by the magnitude, or the weight, or, in particular, by the figure of the calculi, and chiefly when they are forced into the streights of the neck of the bladder, by the bile which they thus retain therein; and at the time when this cyst is compressed by the stomach, and intestines; forced on still farther and farther, that a spasm may then arise, with contractions, and crispatures, which are propagated through the larger and continued ducts of the bile, on the one hand, to the intestinum duodenum, and on the other, to the liver: and I did not doubt but that the passages being thus contracted, a jaundice might be formed, in the manner afterwards particularly explained by Hoffman. Therefore the jaundice, as it can then only be the consequence of gall-stones, and as what these then do by irritating, may be done, at other times, by different causes in different situations, and even by the passions of the mind themselves, this will, therefore, not be the constant, and proper, sign of these cystic concretions.

36. And if the jaundice is not a constant sign, is there any other that is perpetual, and peculiar? I very much fear lest that, which was the case in the time of Fernelius, is also the case at present, and will be so, for the future; I mean that "no manifest marks, by which the existence of these "stones may, certainly, and easily be known," can be found out, but that we must dwell upon "suspensions" only, as we have seen of the jaundice. It does not, however, escape me, that there have been celebrated men, both among the ancients, and moderns, who have attended to these marks with a very laudable industry, and have endeavoured to approve them to every one.

For, in the first place, I see that Coiterus, has published some observations of his own, of these calculi, with an intention "that

therefrom might be learned the symptoms, which are the consequences of this disorder." But these are reduced to a long-continued jaundice, and in one, wherein even the common canal was obstructed, to a continual vomiting of food. In regard to the first of which I have said enough already. And in regard to the second, which is likewise taken notice of by others, how often it is absent, and by how many, and how various causes, besides this, it may be brought on, is certainly manifest to every one.

Others have since added different symptoms, the consideration of which I shall not particularly prosecute, as it naturally appears, that the same thing must be said of colic pains, and other symptoms of that kind, which I have already said of vomiting. And what shall we say, when we see such symptoms advanced, as are diametrically opposite to each other, as for instance, those of costiveness, and laxity of the intestines? Nor does it affect me, to find it asserted in the *Sepulchretum*, that "it is scarcely possible to conceive" of this latter symptom taking place: for it is very clear to me, that when the vesicle is entirely filled up by a calculus, all the bile must, of course, flow continually to the intestines, and if it be acrid in any considerable circumstance; that if sometimes one, and sometimes the other, is true, which I do not doubt, neither of them, consequently, can be the perpetual, and peculiar symptom, of these calculi.

37. But if we omit these symptoms which are common to other disorders, and enquire what the calculus can of itself effect, we shall come back nearly to those things, which, as I have just now taken notice, have been already said by me in the first anatomical epistle. "The calculus, of itself," as Boerhaave also says, "while it remains quiet, produces no disagreeable symptom, except a sense of weight, but irritates by its bulk, its weight, and its roughness." If we transfer these things, which he says of the urinary bladder, to the gall-bladder, do you suppose that this calculus, which is lighter than that of the urinary bladder, and is gradually increased, will discover itself to exist by a sense of weight? We must wait a long time then, till it, at length, acquires a greater weight. But will the sign, which we shall be in want of so long, and in most case always, be then, at length,

sensible at least, and placed beyond a doubt. It was certainly sensible in the noble count of whom Hildanus speaks, since, "for many years, as often as he turned himself from one side to the other in bed, he could perceive a great, and troublesome weight, opposite to the liver, that fell from one side to the other."

But the calculi, contained in his gall-bladder, were so large as to weigh eighteen drachms and a half, and that when in a dried state, for when recent from the body, they were much heavier. But do you suppose these to have been heavier than that great number of calculi, which were found, at one time, by Greiseliuſ, all of which, taken together, weighed thirty drachms? For he has not remarked that the man, in whose body he found them, had ever perceived any weight therefrom.

Yet perhaps you will say, that the vast quantity of fat, which was found in his belly, might possibly obtund this sensation. Were all the bodies extremely fat then, in which these calculi have been found to a considerable weight? At least the woman, in whom the calculi were equal to the weight of twenty-four drachms, does not seem to have been very fat, nor yet the priest, whose calculi weighed twenty drachms, nor the illustrious man, in whom they weighed almost as much. Yet we read of none of these, what Hildanus asserts of the count, when he turned himself in bed, nor do I ever remember to have read the same of any person, whose gall-bladder was loaded with calculi. To this case of the count, I should suppose, from comparing the times together, Stieberus referred, when to an observation of that kind, he objected another "of more than two hundred stones," in the gall-bladder of a man, "who had never made any complaint of an oppressive pain in the right side."

But suppose that many have complained of that same sensation, of which the count above-mentioned complained. Yet at the same time call to mind those sacculi, which hung from the liver, and were loaded with calculi, or call to mind even the gall-bladder itself, which has been found more than once to be distended with a large quantity of thick bile, to a surprising degree. You will, by this reflexion, clearly perceive, that the same sensation may sometimes arise from other causes, besides calculi, or if it arises from calculi, not only from those which the gall-bladder

contains. And it is manifest from these, and other examples, that even the distention, which not only the patient, but the physician, also, by applying his hand to the part, perceives, and consequently, the effect of the bulk of calculi, affords but an ambiguous mark of their existence.

The roughness remains. Of which I say first, as I have already said of the weight, and might have said of the bulk, that it is not always such as can irritate, and discover itself by irritation. And, in the second place, I say, that even when it is of such a kind, the vesicle is, at one time, defended by the quantity, and at another time by the thickness of the bile, from the irritation it has a tendency to create; for that happens very rarely here, which happens almost always in the urinary bladder, that all the contained humour being discharged, nothing remains but the calculus, by which the bladder is pricked, and stimulated, especially as the gall-bladder cannot contract itself like the other, and closely embrace the stone: and although this could happen, yet the sense of both bladders does not seem equally exquisite; and this I say, lest you should have recourse to the turgescency of the stomach, and intestines, which, however, does not always subsist, in order to make us conceive how the cyst may be pressed close upon the calculus.

Finally, I say that in these very viscera, in the part where they can press upon the contiguous vesicle, that the same sense of pricking may happen to exist from another cause, which would be, in the gall-bladder, from a calculus; and even that it may be in this vesicle itself, from the very acrid quality of retained bile, or from some spasm; so that irritations may be either supposed to exist in this receptacle, which are not there, or those which are there, may arise from a cause quite different from calculi.

38. What I have said on both sides of the question then, hitherto, goes so far as to give you to understand, that there is no perpetual, no peculiar, sign of these calculi. But lest you should chance to suspect, that there may be some fallacy in reasoning, as there often is, let us confine ourselves to experience. I set aside all my own observations, and those of Valsalva, in none of which there was any sign of those calculi, that we, nevertheless, found in the gall-bladder. I also set aside those which



I have produced in a former work, from Gerbesius, and Lospicklerus, who assert of men troubled with calculi of the gall-bladder, "that they had lived a long time in health, and had been free from complaints."

But if others testify the same thing besides, is it but just that you should call to mind, all those observations which we now set aside. Rolfinc, therefore, a physician of great eminence in his times, when he describes what kind of calculi he found in the cyst, says, in general, "that stones of the gall-bladder very often lie latent in that cyst, for some years, without doing any injury, sometimes bringing on pain, and sometimes being without. L'Emery the father, affirms it to be well known, that these stones not only do not cause death, but even "frequently cause no inconvenience whatever." And I have already said above, that Vaterus had observed in a woman, who had thirty of them in the gall-bladder, a long-continued, and "perfect health," even to the end of her life.

Galeati, in like manner, affirms, that in a woman, whose body he dissected, "nothing had happened, either in the disease whereof she died," (which was a dropsy) "nor before that time, as far as he could learn, that showed the gall-bladder to be affected;" yet in this vesicle, nevertheless, were four calculi, the largest of which "being angular, had obstructed the orifice of the cystic canal." Themelius, also, when he takes notice of "some biliary calculi, worthy of remark," that were found by him, in the cyst of a strumpet, expressly says, "that they had not been attended with any injury to health."

Finally, Roncallus, for I am not willing to mention any more here, than naturally occur to me as I write, gives an account of seven calculi, of the size of a small walnut, being found, by him, in the gall-bladder of a woman, who died in the eighth month of her pregnancy, and who, in the whole of that time, and long before, "had been endowed with a very good habit of body, was well nourished, and had a good colour;" so that it was manifest, unless these concretions had been formed in an instant of time, which cannot be supposed; "that health may continue," even when these are present.

If I am not by any means deceived then, it is sufficiently demonstrated, that there is no perpetual sign of cystic calculi, and, consequently, that there is none proper, and peculiar.

39. How is it then, you will say, that Wepfer, a very experienced physician, has written these things to Verzascha: "I do not think that the neck of the gall-bladder is stopped up, because there is not the least complaint of a cardialgia, or pain with tension, near to the cartilago ensiformis, the seat of which might be covered with a silver penny?" Did not he, at least, think this an inseparable sign, where the calculus had stopped up the neck of the gall-bladder?

But I would have you attend to this, that he has not made mention of calculi in particular, and that there are other causes besides a calculus, which are capable of obstructing the cystic duct, as well as the other biliary ducts. And in the second place, even when a calculus obstructed this duct, Galeati, as was just now said, did not only not observe a jaundice, which alone was found to be absent, at that time, by Bezoldus, and was proved to be so, in many cases, by Pechlinus, but even remarked that nothing was the consequence of it which could show the cyst to be affected: and the same remarks, nearly, were made by Reverhorst: and by Phil. Jac. Hartmann, in two bodies: nor has Haller any thing contradictory thereto, in the dissection of three bodies: nor, finally, he who could have related with accuracy all the symptoms of a patient, I mean the celebrated Trew.

And although Tacconus says, that very great pains, in the hypogastric region, had been joined with a quartan fever, yet he not only says, that the jaundice had not attended, at the same time, but even that there had not been those pains which reach to the cartilago ensiformis, as he had expressly signified, in another woman, a little before, where he supposed the existence of calculi, in the ductus communis. You see therefore, that not even when the meatus cysticus is obstructed by a calculus, as it was in all the bodies I have referred to, is that pain, which has been described by Wepfer, a constant and perpetual sign of its existence.

40. And although our original enquiry, here, was after the

symptoms of a calculus, not only when thrust down into that passage, but, in general, when existing in the gall-bladder, yet it will not repent me, that I have examined whether the sign described by Wepfer, be proper to a calculus, that is fallen down into the ductus communis, since it cannot be proper to that which remains in the vesicle, as was sufficiently demonstrated above, when I treated slightly of the sense of distention. For as to an observation occurring in the Sepulchretum, to which this title is prefixed, "a pain about the cartilago ensiformis, from calculi in the stomach, and gall-bladder;" take care how you suppose that the observation corresponds with the title: for in reading over the case, you will find, indeed, that many calculi adhered very closely to the fundus, and substance, of the stomach; but that there was any calculus in the gall-bladder, or in any other part, you will not find.

From this observation, therefore, you will rather learn, that it was not a proper symptom of calculi existing in the ductus communis, which showed calculi to be adhering to the stomach. And, indeed, if besides these, others had also existed in the ductus communis, yet there would be room for doubt, to which of these two kinds, this pain ought to be ascribed, just as when in a history of the same kind of pain, calculi are described in that duct, and the liver is said, at the same time, to be almost full of depraved matter, and to have very considerable disorders, and in another, many tumours are said to have existed throughout the liver, and this meatus to have been much compressed by one of them: although, if the compression, or obstruction, of the ductus communis be supposed, of itself, to bring on the cause of that pain, whereof I speak, it, of course, cannot be considered as the peculiar mark of stones sticking therein, as it is sufficiently shewn above, that this canal may be both compressed, and obstructed, without calculi, and as nothing forbids us to imagine, that bile may be sometimes confined therein, in a very great quantity, and that it is sometimes naturally so acrid, or becomes so by stagnation, that it has a power to distend, and to stimulate, the canal in the same manner with calculi.

Do not imagine, however, that the industry and skill of those

who enquire after truth, and endeavour to increase medical knowledge, are less esteemed by me, than by the celebrated man, who proves the explication of the pain in question, by the firm connection of the ligamentum suspensorium of the liver, to the peritonaeum, where it covers the ensiform cartilage: but influenced by the same love of, and desire after, truth, that influence me at present, he soon after subjoins the following words: "and not in calculous affections of the liver only, but in inflammations, or other tumours of the same viscus, which have their seats not far from the roots of this ligament, these things are proper to explain the various symptoms of this kind, that arise from thence, and, particularly, the pain of the cartilago mucronata, of which we speak, and which, in similar circumstances, is frequently found to attend inflammations of the liver."

41. And this symptom is not only common to other disorders that are taken notice of, whether they be seated on the outside of the liver, or within the liver, or in the ductus communis itself, but does not always occur, even at the time when there are stones in this duct. For all biliary calculi, whatever, that are discharged from the intestines, must, of necessity, have passed through the streights of this duct to the intestines: and yet, notwithstanding so many observations are extant, of stones of this kind being discharged with the stools, how few are there in which we read, that a pain at the cartilago ensiformis had preceded the discharge?

It does not, however, escape me, that all the stones, thus discharged, are not to be supposed to have come from the liver. And, indeed, I readily confess, that although from the time in which they first began to be observed, which was before Galen, to this very time, almost innumerable observations of these concretions have been collected by Donatus, by Schenck, by Rhodius, by Schrockius the father, and by others, it seems to me that many of them have been generated in the intestines, or the stomach, itself.

For that they may, also, be generated in the stomach, ancient examples prove, the first of which is related by Donatus, when my fellow-citizen. "Mr. Jo. Juliani, of Forli, sent a stone to Gentilis,

which was thrown up by vomiting, equal to the size of a nut, after a pain of the stomach, which in its hardness exceeded that of gypsum, and was, in its shape, like that of an egg:" and one similar to this, except that it did not exceed the size of a jubebe, was of a whitish colour, and not furnished with evident strata, I formerly saw in the place of my nativity, which a woman had thrown up by vomiting, in like manner, after long-continued pains of the stomach.

But though others have lately thought that they have proved them to be generated in the intestines, by examples which, perhaps, are not very proper for the purpose, to me that seems more suitable to the present occasion, which you will find in Ballo-nius, "of a stone in the intestines, which was "perforated so as to suffer the more liquid matter to pass through it;" for it seems to have been formed, by degrees, of earthy, and viscid, particles adhering, round about, to the intestines: the other particles passing through the middle of it, and keeping the passage open.

Who will venture to deny, that stones which are the largest of all, and universally made up of one, and the same, matter of this kind, had not their first beginning in the intestines, as they certainly had their increase? And indeed although I read that some were of such a kind, either in their magnitude, or colour, or their figure, that any one might easily refer them to the class of cystic concretions, as, for instance, those which were "at one time smaller, and at another time larger, than peas," or "than filberts, those which were of a yellow colour," or "in great part yellow," those which were "triangular," or otherwise "angular;" and, finally, to comprehend many examples in one, "those which in their shape, colour, and magnitude, were like to the seeds of melons;" yet I will readily omit all these, especially as the symptoms which had preceded, are either not related with the necessary accuracy, or not related at all.

I will go on to those which the authors who describe them, or other men of eminence, have considered, and not without reason, as cystic, or, at least, biliary concretions. But Fernelius, whom I have mentioned in a former work, says no more than that he

had found “after a long jaundice, succeeded by a diarrhoea, innumerable calculi of this nature, like peas, or barley-corns, to be discharged by most persons.” Coiterus, in like manner, says that he knew a woman, “who was freed from a very troublesome, and long-continued jaundice, by a discharge of a calculus with her stools.” That Solomon Alberti, “had often observed calculi to be discharged with the faeces, after a very long jaundice,” I know very well from the celebrated Haller: but whether he said more than this I know not, inasmuch as I have not his second “oration,” which he there quotes; not that which is among the three published in the year 1585, but that which is with the four published in 1590, for that that is what he refers to, I do not doubt, as I see it is entitled in Linden, *deffell ad intestina restagnante, &c.*

I have said above, that Malpighi has asserted a stone to be discharged by a matron, “after great pains and a long jaundice.” That Ruysch preserved “a calculus, which came from the gall-bladder, and was discharged *per anum*,” I have read, but not what symptoms had preceded the discharge. And others I purposely omit, who have either said no more than Ruysch, of what had preceded, or have not mentioned so many symptoms as Malpighi.

42. It is better, therefore, to pass over to those who have made mention of the seat of the pain which preceded. Hoffman the father, as the son relates, has said that there had been “very acute pains of the right hypochondrium.” Dillenius, that after pains which had, “for a very long time,” occupied the same hypochondrium, “colico-nephritic pains had succeeded.” Bartholin, from the observation of Tinctorius, “that there had been many complaints of a pain in the right side, which extended to the intestines.” Lentilius, “a very great pain about the region of the liver, with a tumour; of which pain, however, the patient had already complained, for the space of ten years.” Wolfstrigelius, who has spoken more fully on the subject than the others, that pains had, at several times, preceded, “which resembled colico-nephritic pains, and which, though they frequently grew milder, yet as often returned with violence:” and upon a relapse into this

disease, as frequently happens, "there was a pain of the loins, and a rending pain about the right hypochondrium, at the place where the ductus choledocus is inserted into the duodenum:" that the disease returning again, "there was a pain which, indeed, rather resembled a colic pain, as it was not felt about the loins, and right hypochondrium, but chiefly towards the navel."

In fine, our Valisneri, who prosecuted every inquiry, himself, with accuracy, having observed similar cases, first in the place of his nativity, and after that here at Padua also, has said nothing more in regard to pains, than "that they had been very violent in the region of the liver, and had extended themselves towards the navel." The cases proposed by Vaterus, and still more by Bezoldus, I purposely pass over, on account of the magnitude of the calculi, which, though they certainly had their beginning in the gall-bladder, yet, as they might seem to have received their increase in the intestines, should have been then said to have come from thence, rather than from the common biliary canal. And Vaterus says that there had been "very violent, and excruciating pains of the belly, which first occupied the region of the navel, and at length settled in the lumbar region." And Bezoldus, that after the patients "having been surprisingly harrassed for six years and more, with pains of the right hypochondrium," a stone was at length discharged by the intestines, but "not without griping pains." You see then, that in all these observations, no pain is taken notice of, which had its seat about the ensiform cartilage.

Nor is any thing hinted in regard to such a pain, by the two Hoffmanns, Maurice, and Frederic. For the former, though it is true he mentions "the anterior parts," yet mentions them in such a manner, as to say that there had been "a long-continued vellicating pain, with tension, under the right hypochondrium, which was troublesome towards the anterior parts." And although the latter, besides "an intolerable pain in the right side, and under the false ribs," adds the following words; "about the scrobiculus cordis was a violent oppressive pain, which even extended itself into the umbilical region;" yet the scrobiculus cordis does not comprehend the ensiform cartilage, or if you would

have it comprehended in these words, you must then call to mind, that in this observation, the question is not of a "calculus," but of "bilious sordes stopping up the ductus choledocus;" so that by this means those things might rather be confirmed, which I have advanced above, in regard to the ambiguity that must be the consequence of this symptom, which is certainly, also, the consequence of other symptoms, in the next observation of Hoffmann.

However, in the last, where the question is of calculi obstructing that duct, he mentions "an acute, and almost intolerable pain, deeply fixed in the region of the liver, with pains of the intestines, which were troublesome now and then, and remitted at intervals." Finally, turn to those things that are written by the very skilful archiater Van Swieten, where he tells us what he has observed to happen at this time; you will find not a word of pain at the ensiform cartilage. And as upon duly considering all the observations that I have produced, you will observe that the pain was never extended to that cartilage, but to the navel, or the umbilical region, more than once, if you should happen to prefer taking the explication, not from the intestinum jejunum, into which the duodenum is continued, but from that part of the ligamentum suspensorium of the liver which is better known to Eustachius, than to Reverhorst, and accompanies the umbilical ligament, or even from this ligament itself, you are at the same freedom to do it for me, as from the other part of the ligamentum suspensorium, when the pain shall, at any time, extend itself to the ensiform cartilage, as has been observed by others.

43. If, therefore, biliary calculi, as has been demonstrated hitherto, and will be confirmed presently, do not discover themselves, by any constant, and peculiar symptoms, even when they are so far from being in a state of rest, that they are endeavouring to procure a discharge for themselves, how much less will they be able to do that, when they are in a perfect state of rest, in their vesicle?

But you will say that the symptoms of calculi, inherent in the kidneys, and urinary bladder, also, are very frequently ambiguous, and yet not held in contempt by physicians, in so great an obscu-



rity of things. Nor do I despise the symptoms that have been advanced, as marks of the existence of cystic calculi; but I complain that they are more proper to make us suspect their existence, than to convince us that they actually exist. Yet if we are to insist upon suspicions, I not only commend those who endeavour to add some weight to these suspicions, by increasing the number of the symptoms, but, amongst them, I also take the liberty to mention myself.

Therefore, although I know that stones of the cyst are not always joined with bile, which resembles sordes, nor always with urinary calculi, yet I believe that the suspicion of Sylvius, which you even have in the *Sepulchretum*, is not altogether to be despised, who fears lest those that vomit bile of this kind, should have concretions in the gall-bladder; and that another suspicion of my own ought not to be concealed. For I having, besides those that I formerly mentioned, as seen by me, seen others also, and read of others, that have been subject to bilious, and urinary calculi, at the same time: and as in turning over the observations, which I have in part made use of in this letter, I met with a great number likewise; I easily perceived that these things did not happen by chance. Of those who I have read were thus affected, I will not omit one, who deserves to be taken notice of, in preference to the rest, on account of his merits in the medical faculty, I mean Michael Mercati. This gentleman having died of nephritic tortures, and having two stones, of a considerable size, sticking in his ureters, and in his kidneys sixty-three, which were all pretty small, or some of them only, as his preceptor *Caesalpinus* has written, large, had, also, in his gall-bladder (although, as they take notice, he had never been attacked with the jaundice) six and thirty of an obscure color, angular in their figure, and of the bigness of a vetch.

And who is there, that, reading these things of Mercati, and in that great number of observations moreover, that the bishop, mentioned by *Laelius a Fonte*, was wont frequently to labour under the stone of the kidneys, that the count of *Hoechstetter* had a stone, and fabulous formations therein, that the cooper of *Wepfer* had a small stone, in a papillary caruncle of one kidney,

that the woman of Borrichius had discharged calculi from both bladders, that another of Morton had one kidney filled therewith, that the old man of Reverhorst had the same in his kidneys, and urinary bladder, will not suspect the causes to be similar?

And lest you should be inclined to suppose that this happened only in old persons, take notice, I beg of you, that a virgin of eighteen years of age, spoken of by Bonetus, had a stone taken from her by the lithotomist, of the bigness of a goose's egg: add to that that Bergerus had found calculi in both the bladders of a counsellor at Law; Lancisi, also, in the kidney of that excellent man Horatio Albani, both a large stone, and many small ones; and, finally, that Hoffman found one, which was not small in its size, in the kidney of a gentleman, and one much larger in the urinary bladder.

For I shall, designedly, take no notice of a great number of other authors, and among these Jo. Bapt. Contulus, Christophor. Cunradus, Vitus Riedlinus, Tob. Ferd. Pauli, Jo. Caspar. Grimmerius, Jo. Sebastian Albrechtus, Jo. Jacob. Trelyngius, Christoph. Jac. Trew, who observed the same in two bodies, Jo. Storck, and Isr. Cregutus: these, I say, and others, I shall omit, since besides Baglivi, who so far considers this as what generally happens, that he had enquired into the reason, "why, when there are calculi in the gall-bladder they also are generated in the urinary bladder, and vice versa," the testimony of Abraham Vater alone may pass for many, who expressly affirms, "that calculi have, beyond a doubt, been very frequently observed in the gall-bladder, in those who have, at the same time, laboured under a calculus of the urinary passages."

Who then can read such testimonies, and attend to so many similar cases, without immediately conceiving with Vaterus, "that the causes" of both species of calculi are, in a great measure, "evidently common to each other?" And if you take this for granted, you will, doubtless, begin to think with me, that when to the other marks of bilious calculi, this also shall be added, that the patient is subject to calculi of the urinary passages, some weight will be given to the other suspicions; especially if, according to what has been observed above, this patient is neither an

infant, nor a child, but is already in a middle age, or advanced in life: which remark, drawn from the age of the patient, may, if joined with others, help us to distinguish intestinal calculi, that have been discharged by stool, from such as are generated in the liver.

Thus the celebrated Carlius, when he had not believed that a certain calculus, which was reckoned among cystic calculi, and which had been discharged among the faeces, by a boy of eighteen years of age, did really belong to that class, for this reason "in particular, because such an age does not naturally bring on a disposition of that kind" (and it certainly does not, except very rarely, which is one point, wherein bilious, and urinary, calculi do not agree with each other) knew afterwards, that the liver of this young man, who had died of a dysentery, was found to be as sound as that of the most "healthy young animal can be:" whereas the calculus "of two ounces and a half in weight," for such it was, though it might have received the greater part of its increase in the intestines, would, at least, have left some trace of its former residence, and passage, in the gall-bladder, and the ducts affixed to the liver.

44. But although the marks of bilious calculi, which I have taken notice of, are, as appears from those things that I have hitherto said, as Hoffman admonishes, "to be taken and considered collectively:" and as all these marks cannot exist in all persons, the greater part of them, at least, and among these the principal are to be attended to (by the principal, I mean those which are wont to be the more frequently observed, as, for instance, when stones descend into the ductus communis, there is certainly a pain seated on the right side, a jaundice, vomiting, anxiety, relapse; for so I have in general observed, in many of those observations that are pointed out above), although, I say, we must proceed in the manner I have said, yet we ought never to forget, how easily a deception may happen.

For if you compare with the greater part, or the principal of these marks, these two observations of Hoffman, which I even referred to before, you will find that my surmises are not without foundation. And you will perceive the same thing, when, after

having said "that there are some symptoms which prove the existence of calculi, in the biliary ducts, that are by no means fallacious," and enumerated the chief of them, he presently produces the signs of a very large calculus, sticking in the gall-bladder; but especially, when he describes the symptoms of a jaundice, which was not brought on by any calculus, but only by a spasmodic stricture."

Yet it not uncommonly happens, that as in urinary calculi, so in biliary also, we have a mark of their existence which is much more to be depended upon than the others; I mean when any one of these concretions, or some fragment of them, at least, is discharged. And as this very sign, which is evident even from the natural light of reason, was mentioned by others before, and among these by Vaterus, but particularly, and fully, by Vallisneri, it may seem very surprising to any one, why it is omitted by Hoffman, among those signs that are "by no means fallacious;" especially as, five years before, this very author had taught the following things, "but among all these signs, which I have already admonished you of, there is none more certain, whereby to judge of violent affections proceeding from the biliary calculi, than the discharge thereof, together with the intestinal faeces; and then, just as it happens, in the case of renal calculi, when they have been carried down from the ureters, into the bladder, all the pains, together with the other violent affections, instantly and totally cease, and expire, at least if you except the jaundice, which does not immediately, but gradually disappear."

When, therefore, the signs of calculi having intruded themselves into the biliary ducts, and endeavouring to procure an exit for themselves into the intestinum duodenum, have preceded; if among the faeces discharged from the intestines, which ought then to be carefully washed by servants, and, according to the admonition of Vallisneri, passed through a kind of sieve, any biliary calculus be found, it is not to be doubted, but this sign must throw such a light upon the case, as could not be hoped from so many other marks, that are, at best, but uncertain, and, in some measure, obscure.

45. But there is need of caution, lest we should happen, at any

time, to take an intestinal calculus for a biliary one, or, that all the ambiguity of words may be avoided here, for an hepatic calculus, that is a stone which is generated in the canals of the liver, or its appendage the gall-bladder.

There is a certain observation in Hoffman, of twenty stones being discharged by vomiting; in regard to which, although he did not think it altogether incredible, that they should have proceeded from the biliary ducts, he, nevertheless, rather supposed them "to have been generated from the successive, and alternate, concretions of very viscid, and earthy bile, in the flexure "of the *intestinum duodenum* itself:" for they were angular, and of a yellow colour inclining to green; and of such a magnitude, that without excruciating pains in the right side of the belly, none of which had preceded, it did not seem possible for them to have passed through the *ductus communis*.

Yet a jaundice had preceded the discharge of these stones, and "immediately" after this discharge, which ought to seem very astonishing to those who attend to the exception of Hoffman, just now mentioned, "was removed." If, therefore, as they prevented the passage of the bile into the *duodenum* by their obstruction, so the bile either naturally, or by stagnation, was made acrid, or these calculi had very acute angles, you readily perceive, that not only a jaundice, but pains in the right side also, and other symptoms that are the consequences of them, might have been previously caused by them, and even have been removed by their discharge.

But it is rather possible that these symptoms may be joined together, than frequent: and no pains of the right side having preceded, in the observation in question, might have rendered the physician sufficiently cautious. The absence of which, or of the jaundice, and still more of both, ought in like manner to render him cautious, when calculi, which might otherwise seem to be cystic, are discharged from the intestines, as in those examples that will be immediately pointed out. And first, three calculi occur to my mind, that were discharged in the manner I have mentioned; of which, whether you attend to the globular, or oval figure, to the external, or internal colour, and some other

circumstances, you certainly will not be forward to deny that they might be cystic calculi, particularly if you call to mind that some very similar have been, at times, found in the gall-bladder: yet when you read that there had been gripings and pains of the belly, but none in the right hypochondrium, and even that, in one instance, there were oppressive pains in the iliac region, you will believe that they were intestinal calculi, and that so much the more readily, as you will see that not a jaundice, but a volvulus, is taken notice of, in each of these three cases.

Three other instances succeed. In regard to the first of which, if it made any mention of the jaundice, and did not say that the stones were discharged "without any pains," their description would so much the more incline us to take them for cystic calculi; as, in their size, they were by no means to be compared with those that are mentioned in the three former, and in as many subsequent, examples. The second of these mentions colic pains indeed; but not in the right hypochondrium, nor joined with a jaundice. For which reason I should more readily suppose, with the observer of this instance, that the calculus, although furnished with concentric shells, as the figure shows, and internally, and externally, yellow, had been generated in some intestine, pretty near to the entrance of the bile.

So in the third example, I agree with the celebrated Albrechtus, who supposes the calculi to have been formed in the intestinum colon; which calculi he, nevertheless, describes, of a triangular figure, swimming in water, and inflammable: I agree, I say, not so much because they contained, under an obscure external yellowness, a very white matter which was, however, solid, "like pretty hard soap," as because a violent pain was not wanting in the right hypochondrium. But, to take no notice of "the odour of impure lard," which proceeded from them in burning, and other circumstances, I do not see that any thing is any where observed in relation to the jaundice.

Finally, out of the four examples which I, at present, chuse to add, if the calculus which is so slightly mentioned by the celebrated God. Guil. Muller, as to call it "bilious," and to represent it as being formed of strata, which inclosed each other, could

have been described more fully, and we could have known with what previous, or concomitant, symptoms it had been discharged, perhaps I should admit it without any doubt: as I do certainly admit those, that the celebrated Jo. Phil. Burggrave describes, as being discharged after violent, and those returning, pains of the right hypochondrium, not without an icteric colour, both in the face and in the urine. And some that were seen by the celebrated Brunnerus, although they were without a jaundice, we must, of course, admit for this reason, because by dissection, he found them already begun in the liver.

That is to say, a man having been troubled, almost ten years, with a constant pain of the belly, and particularly of the right hypochondrium, which at first was heavy, and obtuse, though attended with tension, but afterwards, at times, became acute, and, at length, very severe, nor changed its situation from the right hypochondrium, so as to be at last intolerable, discharged light, and yellow calculi, which were of a lamellated structure, and angular in their figure. This man dying after three days, had in his gall-bladder, which was enlarged, a mass of a dark red colour, inclining to blue, and green, and soft in its consistence; and in the middle of the cystic duct, and in the common duct, where it opens obliquely into the intestinum duodenum, a matter adhered, which was somewhat less soft indeed, but, nevertheless, formed by those ducts, into two "oblong and rounded" globules: finally, in the colon were found fifteen calculi compacted into one globe, but easily separable, and not yet so hard as those which had been discharged by stool.

It could not, therefore, be denied that these had been begun in the biliary ducts; and that having become, by degrees, less soft, they were, at length, hardened by their abode in the intestines. And if "through the whole of the disease, no sign of a jaundice manifested itself," either suppose that the matter was certainly more soft in the living body, than on the third day after death, when it was found in the ducts; and that therefore it not altogether obstructed the discharge of the bile, and had, perhaps, created pains by its acrimony, more than by its obstruction: or call to mind those things which I have hinted above, in a

singular case of this kind, in order to conceive, that even when the common duct is obstructed, a jaundice may sometimes be absent. And in consideration of this it was, I just now said that the absence of the jaundice, but still more the absence of both jaundice, and pain, on the right side, ought to render the physician cautious, and make him attend to all the other symptoms, united, before he pronounces any thing.

Wherefore, to subjoin the fourth example, I shall not very readily exclude from the number of hepatic calculi, those which Fr. Slare saw, and which were discharged by a noble woman, "who had been very much excruciated with hepatic pains," at two different times, and in a few hours after the pain: for although in writing the case with brevity, as frequently happens, he has, perhaps, omitted what related to the jaundice, yet he has not omitted the odour of the calculi (that is when burnt) their colour, their taste, agreeing with that of bile, and besides these their lightness in water, and their inflammability. And I could wish that these two last-mentioned marks were either never at all observed in intestinal calculi, or at least always in hepatic; it would certainly be much more easy for physicians to take care, lest the one, as Matthiolus formerly feared, should be taken for the other.

But it has been shown, that those two signs, which most physicians made use of, with Reverhorst, are frequently fallacious. And if Vallisneri admonished us to beware, lest any calculi should be hastily thrown out from the number of hepatic calculi, for this reason, because they neither swam in water, nor were inflammable; and this at a time when we had begun to weaken the credit of these signs, by a very few experiments only; how much more does it behove us to beware at present, when the experiments have multiplied upon us, to such a degree, that it does not seem possible to reduce the exceptions to any certain heads.

And how much cystic calculi may vary, not only in colour, and form, but even in the very external, and internal structure, and in the mode of their substance likewise, so as to be even sometimes pellucid, has been accurately remarked above; lest if any should, at times, occur, which differ in some respects, or even consider-



ably, from the common appearance of biliary calculi, you immediately pronounce that they are not hepatic; and that you may previously, and particularly, consider the other properties, and well weigh all the symptoms, which have preceded, accompanied, or been the consequents of their excretion.

46. Nor indeed need the magnitude itself, to say nothing of the immense number, always deter you from supposing them to be hepatic. That the calculus was, without doubt, "of a surprising magnitude," which a certain woman had discharged by stool, *Vaterus* testifies: and yet the woman dying a little after its discharge, five others, of a lesser size, were found in her gall-bladder, being "of such a figure that it might be seen how they had adhered to that larger one," which resembled a little heart. You see, therefore, that this had all been in the cyst with them; and that its magnitude was no hindrance to its being discharged from thence, and coming down into the cavity of the intestines.

That also was large, inasmuch as it "equalled the joint of a man's thumb," which the mother-in-law of the celebrated *Van Swieten*, who was liable to periodical paroxysms of the jaundice, discharged from the intestines, at the end of two days, after very severe, and excruciating, pains in the seat of the duodenum itself; and which was hollowed out into two cavities on its surface, that showed two calculi still to remain, which were, themselves, also discharged afterwards, being not much less in size than the former. And yet the great bulk of this calculus had not prevented it from struggling through the narrow passages of the ducts.

Nor is it to be wondered at: for although the ductus choledocus is narrow, although the cystic is still more narrow, and the passage of it impeded by valves, they are nevertheless membranous, and, for that reason, can bear almost incredible dilatation. And from this cause it was that *Bezoldus*, found the cystic duct "eight times larger than it generally is, so as to equal the thickness of a man's thumb; and in the middle of its length, a calculus of a remarkable size." And I myself, as is said elsewhere, have seen, "the common and cystic ducts, and the hepatic quite within the liver, so dilated as to have a circumference equal to two inches,"

in an old man, in whose cyst, but particularly in the branches of the hepatic duct, I found calculi.

But in a woman whose gall-bladder contained a large calculus, although not yet quite indurated, the orifice of the common canal, where it opens into the duodenum, which is, at other times, very narrow, was seen, by Heister, to be so dilated, "that it could with ease admit the little finger of a man." And Hen. Albertus Nicolai, having found the same canal expanded quite to the gall-bladder, "in a very extraordinary manner," found the orifice no less open than it was found by Heister. But the younger du Verney had even seen it larger. And Trew had seen it very lax in a body, wherein the biliary ducts were equally dilated: the diameter of which, was found to be three times larger than it naturally is, by Kniphofius.

Other observations of this kind, which were at hand, I omit to mention; for these that I have mentioned, are not only sufficient, but I shall produce some presently, among which there will be one instance of a much greater dilatation. Since, therefore, these canals may be so dilated, and are found to be so dilated, there is no reason why we should doubt that gall-stones, even when they are of a considerable size, may pass through them; except when those pains in the right hypochondrium, which are the natural effects of such a dilatation, have not preceded. Wherefore as I commend Hoffmann, when speaking of those twenty stones of a remarkable size, for not supposing it altogether incredible, that in the ducts whereof I speak, "very small bilious calculi might first adhere, and, by degrees, get an increase from the bile which flowed by them, and a great dilatation of these ducts being successively made, be obstructed there, for a long time;" so again I commend the same author, even still more, because he has shown himself to be doubtful, and even more inclined to the contrary opinion, for this reason, because these stones had been discharged, "without any violent pains of the right side having preceded."

I also set down as commendable in Bezoldus, that though pains of the right hypochondrium had, for the space of six years and more, preceded the discharge of a gall-stone; and although he,

himself, and not without reason, judged it to have proceeded from the biliary ducts; yet he professed that he would "not obstinately adhere to the opinion," I suppose because there had not been an unusual severity of pain in that part, and greater than at any other time, when the stone, having, at length, overcome the narrow passes of the orifice of the ductus communis, suddenly burst forth into the intestine; or, at least, because there had been no exacerbation of pain, in proportion to the great bulk of the stone: and if it had been confined in these ducts so long a time, it certainly could not but have brought on a jaundice, unless from extraordinary disposition of the ducts be supposed; yet there is not a word said of either of these appearances.

I wish I could speak equally in commendation of Abraham Vater, in other respects a learned, and sagacious physician, who does not doubt but two calculi "of a considerable magnitude," that were discharged by stool, "came quite from the gall-bladder, although "neither pain, nor any other troublesome symptom, had been previously perceived from them," and though, even at the time, the excruciating pains of the belly were not seated in the right hypochondrium, but "had first occupied the umbilical region, and, at length, fallen upon the region of the loins." Yet he is not without his weight of reasons. But while among these, he produces examples of the very great dilatation of the very narrow osculum uteri in child-birth, and of the great distention of the slender ureters in calculous patients, it is surprizing, it never occurred to him, that neither the one, nor the other, is ever dilated, without severe pains.

47. However, let us see what may be said for Vaterus. An observation of Traffelmann is extant in Schenck, in which he describes "the meatus of the bile, where it is inserted into the duodenum," as he himself had found it, "wide, inflated like a stomach, and filled on every side with calculi," some larger, and some smaller. If you ask what was the proximate cause of the patient's death (who was a man of princely rank); it was a coma vigil, degenerating into an apoplexy. If with what symptoms he was previously troubled, you will find nothing at all, beside an incredible thirst, wherewith he had been tortured all his life-time.

And can you suppose, that the physician who made this observation, and who appears to have been a diligent man, would, if a jaundice, or any pain in the right hypochondrium, or if any other symptom, which related to the meatus of the bile being so distended with calculi, had afflicted his own prince, either have been ignorant of it, or have passed it over, in an observation which was not very short? But if you do not believe this, you must of course acknowledge, that besides another duct by which bile might be carried to the intestines, and a jaundice prevented, it is possible that the meatus choledocus may, by means of calculi, which were before very few, being gradually increased therein, both in number, and magnitude, be immoderately distended indeed, but so slowly, and gently, that the patient may not at all complain of it.

Yet whatever you may think of this case, you will always be of opinion with me, that these things are very rare, and will, at the same time, observe, that quite a different judgment is to be formed of quiescent calculi, and of those which have passed through the streights of the whole cystic, and common duct, even to its termination, by force. I do not, however, require, that as in the observation of Tinctorius, after a pain of the right side, which was extended to the intestines, there be discharged, together with the calculi, "a bloody and purulent matter;" it is sufficient for me, as it was for Bartholin, "that the ductus choledocus alone was dilated," which was seen by him, on a similar occasion; and as, sometimes, during this dilatation, when the calculi are confined in the narrow parts of the ducts, and begin to be moved from thence, the ducts are hurt by the angles of the calculi, and the discharge, at length, happens not without the rupture of an abscess, which was thus brought on, and an excretion of blood and pus by stool, so, for the most part, this dilatation happens with much less violence, but scarcely ever without pain.

I have already described in a former work, and taken notice of, even in the preceding letter, an observation of Valsalva, in which the upper part of the ductus choledocus communicated with the large cavity of an hepatic abscess, and the other part of it was

enlarged so as to admit the finger, and, by this means, show how in a living body, it could transmit more than two hundred vesicles, with which even then that abscess abounded, to the intestine. Of the many which had formerly been discharged by that meatus, it is probable that some had been obstructed in the narrow part of the duct, by coagula of blood, and that the bile, the passage of which was restrained, had by forcing from above downwards, together with the blood, dilated the canal.

This, however, is certain, that the morbus regius, vomitings, and pains, in particular, had preceded, which pains were so violent in the right hypochondrium, as frequently to excite the most severe distentions of the nerves. Which symptoms, and others there advanced, though you may in great measure refer to so very considerable a disease of the liver, yet if any one should choose to refer some part of them to the dilatation of the meatus choledocus, you certainly cannot deny the plausibility of his opinion. And if you do not deny that this may happen without pain, in a duct which is not irritated by angular, rough, and large stones, but even relaxed by blood, and ichorous matter, often flowing through it, consider whether you can possibly suppose, that the same can happen without pains when the lower streights of this duct have not been previously relaxed, but even contracted, from the irritations of the calculi?

48. Do not expect that I should make this letter, which is already too long, still longer, by adding many things in regard to the cure of this disease. Of which it will be sufficient to hint a few things. I have already said that this disorder often recurs, nor is certainly known, unless when some calculus has been discharged, which previous pains about the region of the liver, had proved to have proceeded from thence. Therefore, one part of the cure will be to endeavour, when very sharp pains of this kind shall return, that the calculus may be dislodged from these streights. A second part, that if any other calculus remains, after this has been dislodged, it may, if possible, be dissolved. A third, to prevent the generation of new calculi. And each of these parts of the cure are to be attended to separately, and distinguished according to our position, nor ought the times, which belong to

every one of them, be rashly confounded, as some seem to do, who heap up remedies promiscuously upon their patients; but the nature of the case, and the analogous cure of the urinary calculus, which is distinct in like manner, ought to be set before our eyes.

49. When the patient, then, is attacked with these violent pains, we must do all in our power to appease them, not only to prevent his being racked, and falling into danger of inflammation, or distention of the nerves, but also that the calculus may get through the narrow passages. For the more this concretion, like a heterogenous body, irritates the ducts, the more the ducts are contracted upon the calculus, for which reason they both increase their own tortures, and prevent the passage of the stone. For this reason it is necessary to relax again and again: and to those things which are, of themselves, relaxing, and emollient, must be added, for the same end, diluters, demulcents, anodynes, and the most temperate antispasmodics, and, if intolerable pain compels you, even opiates.

Nor is it necessary to relax, only by internal remedies, but also by remedies externally applied, as far as it is in our power; I mean by the use of clysters, unctions, fomentations, and baths. To all which, where there is a fulness of blood, I do not see why venaesection should not be premised, not only to prevent the chance of an inflammation being brought on, but also to prevent the passages from being streightened, by the turgescency of the small vessels. Moreover, as I recommend every thing that may relax, so I violently suspect every thing that can irritate. For the detriment which they bring, by forcing the ducts to contract themselves, and become still narrower, is certain; and the advantage which many expect from the impulsion, and extrusion, of the calculus, uncertain.

Yet there are, you will say, instances of calculi reported, which powerful impellents, or strong emetics, and purgatives, have dislodged. I grant it. But who dares, purposely, to imitate the happy rashness of a case, without knowing (and who can for certain know?) that the passages are, already, sufficiently relaxed, so that nothing but the last impulsion, and agitation, is wanting;

and that the case, at present, is not quite the reverse, so that by this rash and hasty method, the calculus must be thrown into streights, from whence nothing can dislodge it; by which, not only the pains become more excruciating, but the danger is greatly increased.

And indeed I see Hoffmann asserting, that emetics "are often found to be highly pernicious, . . . if a calculus, inherent in the ductus cysticus, produces very grievous anxieties about the praecordia;" and Reverhorst "readily confessing," that emetics "are a doubtful kind of remedy," whatever duct is obstructed by the calculus; and, finally, Scheffelius, purposely to omit others, for the sake of brevity, expressly says, in regard to purging medicines: "this I certainly would not imitate, as I should fear lest the calculi were so situated, at the same time, that they could not be expelled, but might be disturbed in their situation, and the pains from thence, exasperated," which even anger alone, as he immediately shows, and not only the stimulus of purging medicines, easily excites.

50. You perceive that he speaks of purging medicines, at the time, also, when the pains have ceased, by reason of the calculus being discharged: which is the second part of the cure. And I would, even then, abstain from purgatives, for the reasons just now mentioned, and would rather cleanse the intestines, by more mild remedies, lest the calculus that has been thrown into their canal, should happen to be obstructed there, and get such an increase of bulk, as would make it, some time or other, hurtful to the patient. And I would have you beware of calling me a too timid practitioner, for this reason, or if you choose it, even call me so; for I am less afraid of this, than of being called a very bold one, or, at least, in this species of disorder, in particular, wherein, as is demonstrated above frequently no kind of inconvenience is perceived, when the calculi are in a state of rest. For which reason I would have you cease to wonder, that in this second part of the cure, I have omitted the consideration of impellents, and have only proposed this one thing to be done, I mean that if any calculus should happen to remain, it may be dissolved, provided it be possible to dissolve it.

It does not, however, escape me, how little the remedies, recommended for this purpose, generally answer the expectations of the patient, or the promises of the practitioner, whether they are of a mild kind, which I would willingly admit, or of a very acrid nature, or in any measure irritating, which I would shun. Nor is it to be wondered at; since even out of the body, the calculi which are long preserved in those fluids, by which, within the body, they are supposed to be dissolved, are by no means dissolved, unless they happen to be of the softer kind, such as Borrichius saw "almost wholly dissolved in warm water," and after him Hoffman; and I, even in water which was not warm, have seen them contract fissures, and burst into fragments, as I have written to Schroeckius. And they even sometimes, of themselves, break asunder into small pieces, as I have observed in some black ones; or even melt into a moisture, as that which Lanzonus observed "to be spontaneously dissolved, into a green liquor."

For although, in order to describe this calculus, he says that "he had found the whole of the bilious juice to be stony," he has either abused the word "stony," in order to say that the bile was converted into a calculus, or the crust seemed in great part to be stony, whereas the internal substance was very soft. On the contrary, the juncture may be very soft, and the substance, nevertheless, extremely compact. Thus Platner saw that the fragments of a calculus, which, not being very close, "had soon fallen into pieces, could neither be dissolved by warm water, nor by spirit of wine, although they were steeped in these liquors, for several days together, in a warm place." So also Bezoldus, having left little pieces of calculi, both in warm water, and spirit of wine, even rectified for some time, did not see that they were "entirely dissolved." Nor did Hoffmann see "that gall-stones, which were of a more solid texture, and saturated colour," were dissolved in this manner.

Vallisneri, on the other hand, has experienced that they are dissolved by no liquor more easily, than by rectified spirits of wine made hot, and the spirit of turpentine. And in regard to the spirit of wine, he has the author of whom Haller speaks agree-



ing with him; but some dissent from him in regard to the other spirit, and amongst these Tacconus, who entirely differs in respect to them both. The same author; not to be too prolix, since you may, of yourself, see in the authors, whose names I have mentioned, and in others also, such experiments made with these and other liquors; the same author, I say, although he had seen one of those calculi, of which he has first spoken, that he had thrown into spirit of nitre, "become very tender," nevertheless affirms of those which he speaks of last, that they "were not at all changed" by that spirit, which both Vallisneri, and Bezoldus, had, in like manner, observed.

From these varieties you will, moreover, learn this circumstance, that we should not know what lithontriptic we ought to use, in this, or in that particular case, if it were certain, that these calculi, as they are, for the most part, less hard, and more friable, than the urinary calculi, so they are more easily dissolved by their peculiar lithontriptics: although in comparing both together, not only the substance, and the adhesion, or joining, of the parts are to be considered, but also how much sooner the dissolvent liquor, and how much greater a quantity of it, is carried to the urinary passages than to the biliary.

And on account of this animadversion it was, that, although in the first part of this cure, very large draughts of warm water are proposed by many, I said nothing thereof, which is a subject I should not have been silent upon, if the same were proposed, when a calculus was confined in the kidneys, or ureters. Yet if you ask which I would select in particular, out of such a number of different remedies, that are promiscuously recommended by many, in this second part of the cure; no others more readily, I shall answer, than those which are the most incapable of doing harm; as, for instance, the juice of taraxacum, since with this Boerhaave is said, by his disciple Schesselius, "to have often cured the calculus of the liver successfully," or of fresh grass, which has been celebrated by every body, since Glisson, and Sylvius, for this purpose. And certainly the illustrious Van Swieten, has shown what may be done in such a case, by this one herb alone, from the example of a certain pauper.

This author, also, having overcome this disorder in others, likewise, by decoctions of grass, and taraxacum, and by other things taken constantly, for a long time together, says, "that he had then always found calculi, or, at least, calculous coagula, in a very considerable quantity, in the stools." And although he confesses, that he was not, for this reason, certain that these were "the parts of comminuted calculi," rather than the small beginnings of new calculi, such as I have more than once demonstrated, above, to be found in the cyst; yet the observations of Glisson, which he himself also allows of, sufficiently show that those calculous tubuli which are formed in the biliary passages, of oxen, in the winter, are dissolved by feeding on fresh grass; for otherwise, he would not have found these tubuli frequently "about the time of Lent, or Easter only, or before," but afterwards equally.

51. Finally, the third part of the cure will prevent new calculi being generated, in the first place, if it shall be able to amend whatever disorders there may be in the liver, and, in like manner, in the blood, upon which the production of calculi depends: in the second place, if it remove those things by which these disorders are used to be brought on. These disorders in the liver, are a weakness, laxity, obstruction, and other things of the like kind; and in the blood a quantity of viscid and earthy particles, and a slow propulsion thereof, especially through the liver. Moreover, these disorders are brought on by the too frequent use of unwholesome meats, and drinks, but the bad digestion of the same; by the quantity of diluting liquors not answering to the quantity of food taken in; by too much sleep; by a sedentary life; especially by bending the body too much forwards; by violent passions of the mind, and any other causes which you see plainly, of yourself, ought to be removed by the physician.

But, without doubt, this part of the cure is sufficiently treated of by many. Yet as it very often happens, either by the conformity of the patient not being sufficiently continued, or by the difficulty of bringing back the liver to its perfect sound state, just as we see in the case of urinary calculi, that new ones are generated; nevertheless, it will, at least, be worth while to endeavour,

that, as far as is possible, the canals of the bile may be preserved soft, and lax, that they may not give great resistance to the new calculi which are to pass through them, but may easily yield; and this will be brought about, by means of a continual, but moderate, use of diluters.

52. As to the lithotomy which has also lately been thought of, in the gall-bladder, do not be surprized that I made no mention of it above. For, in the first place, the pains which are excited by gall-stones, that are endeavouring to discharge themselves, are not only brought on by those which come from the cyst, but also by those that come from the hepatic duct. In the second place, those cystic stones which are the largest, and on account of which this lithotomy seems, to some persons, to be chiefly desirable, neither endeavour to disengage themselves, nor create any great uneasiness; or, at least, for the most part. And to these we may add, that unless some accident has united the gall-bladder with the peritoneum, the cutting of it is destructive; and although this connexion has taken place, in some bodies, from the effect of disease, in which chance gave occasion to suggest this new species of lithotomy, as it often has suggested other things, yet how seldom such a connexion is met with, even in a morbid state of these parts, is well known to anatomists: and surgeons know very well, how difficult it is to be certain when it does really exist.

Last of all, although there were no danger in cutting, can you suppose there would be no great difficulty in healing the wound? We have, before our eyes, examples of three women, one of Bologna, of Francfort, and of Gottingen, in whom a tumour, having arisen in the epigastrium, and being opened, either by art, or spontaneously, discharged cystic calculi at its aperture. I read that the first was cured: that the second had a fistula left, by which a thin and chylous kind of liquor, but of a yellow colour, distilled: and the third had an ulcer remain, which, with its sanies, discharged "bilious calculi at times." And this last history may, perhaps, lead the surgeons into hesitation, whether the wound should be shut up afterwards, or kept open, in some measure, for fear of new calculi.

It does not escape me, however, that before the swelling occupies all the muscles which lie before the cyst, causes a considerable suppuration on all sides, and the pus forms winding sinusses for itself, which require so much diligence, and application, in the cure, as in the Franckfort woman; it does not, I say, escape me, that the case must, of course, turn out more successfully, with those who open, by incision, the cyst which has now closely coalesced with the peritoneum: and that the signs of such a coalition have been pointed out by a skilful surgeon. Nevertheless, as it is a thing that is entirely new, notwithstanding it may sometimes have great utility, I thought it rather became me to wait till time shall confirm its advantage, and remove all doubts, dangers, and difficulties, by many repeated experiments, than to be in haste to propose the operation, just as if it were altogether perfect.

53. Thus you have a treatise on biliary calculi; not that, indeed, which Vallisneri wished for; but as much as it was in my power cursorily to add to these things of which I had written, less at large, before, once, twice, and even three times. And if Sosisgenes, as you have it in Pliny, "in his three meditations, although he was more accurate than others, did not cease to have doubts, and frequently to correct himself;" do not wonder that I, though not a negligent man indeed, but yet by no means to be compared with those who have hitherto written of these calculi, should have added this fourth meditation to the three former. Farewell.







# MEDICAL CLASSICS

*Compiled by*  
EMERSON CROSBY KELLY, M.D., F.A.C.S.  
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## Austin Flint

### BIOGRAPHY

- 1812 Born October 20, at Petersham, Massachusetts, the fourth in succession of a medical ancestry, his father being a surgeon. Educated at Amherst College.
- 1833 Age 21. Graduated from Harvard Medical School where he had been under the guidance of such men as James Jackson, Sr., John C. Warren and Jacob Bigelow. At once began practice in Boston and Northampton.
- 1835 Age 23. Married a daughter of Mr. N. W. Skillings of Boston and became father of one child, Austin Flint, Jr. (1836-1915), a famous physiologist and alienist.
- 1836 Age 24. Moved to Buffalo and established a practice.
- 1842 Age 30. Appointed health officer of Buffalo.
- 1844 Age 32. Called to Chicago as professor of medical theory and practice in Rush Medical College, for one year.
- 1845 Age 33. Returned to Buffalo. Helped found the Buffalo Medical Journal, became editor and held that position for ten years.
- 1846 Age 34. Acted as a delegate from the Buffalo Medical Association to the National Medical Convention which met in New York City. Appointed one of a committee to report on elevation and uniformity of requirements for the degree of M.D. in all the medical schools of the United States. When the report was made in 1847, the National Medical Convention took the name of the American Medical Association.
- 1847 Age 35. Aided in the founding of the Buffalo Medical College and became its first professor of the theory

and practice of medicine. Continued in that capacity until his departure from Buffalo in 1852.

1852 Age 40. Professor of medical theory and practice in the University of Louisville.

1856 Age 42. Returned to Buffalo and took the position of professor of pathology and clinical medicine at the Medical College.

1858 Age 44. Became professor of clinical medicine in the New Orleans School of Medicine and a visiting physician to the Charity Hospital. Returned to Buffalo each summer for the warm months.

1860 Age 48. Made his last move and became physician to the Bellevue Hospital in New York City and professor of the principles and practice of medicine there, continuing in these capacities until his death. Also took the position of professor of pathology and practical medicine in the Long Island College Hospital, continuing for eight years, when overwork forced him to curtail his activities to some extent.

1868 Age 56. Selected as orator of the New York Academy of Medicine.

1873 Age 61. Became president of the New York Academy of Medicine after serving for one year as vice-president.

1881 Age 69. Delegate to the International Medical Congress in London. Elected an honorary vice-president. At the next meeting in 1884, elected president to serve in Washington, D. C. in 1887, but death intervened.

1884 Age 72. President of the American Medical Association.

1886 Age 74. Died March 13 of a cerebral apoplexy in New York City and was buried in Boston.

Fellow of the Pennsylvania College of Physicians. Honorary Member of the Medical Society of London. Honorary Member of the Clinical Society of London. LL.D. from Yale University.

## EPONYMS

**LAW:** "An elevation of pitch always accompanies diminution of resonance in consequence of pulmonary consolidation. In other words, dullness of resonance is never present without the pitch being raised."

**MURMUR:** A loud presystolic murmur at the apex in aortic regurgitation; the mitral direct murmur. "In some cases in which free aortic regurgitation exists, the left ventricle becoming filled before the auricles contract, the mitral curtains are floated out, and the valve closed when the mitral current takes place, and, under these circumstances, this murmur may be produced by the current just named, although no mitral lesion exists."

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## INTRODUCTION

Physical diagnosis of diseases of the chest began with Leopold Auenbrugger who as a boy learned to rap on the wine casks in his father's inn to determine the quantity of wine contained. Leopold was a good musician and his keen sense of hearing readily perceived differences in sound. He became a medical student under van Swieten and eventually physician at the Spanish Hospital in Vienna. He early recognized that the chest was as resonant as a wine cask and that the nature of the contents of the chest determined the sound produced when the chest wall was percussed. For seven years Auenbrugger studied his method and in the year 1761, the same year in which Morgagni published his *De sedibus et causis morborum*, Auenbrugger published his *Inventum novum ex percussione thoracis humani, ut signo abstrusos interni pectoris morbos detegendi*, or in its English translation, *On percussion of the chest*.

Auenbrugger's work was neglected until 1808 when the French clinician Corversart made a translation and introduced the work into French clinics.

In 1819 the French internist Laennec published his book on auscultation in which he described an instrument he had recently invented, the stethoscope, for the examination of the chest. This book is one of the most valuable of the medical classics and places its author among the greatest clinicians of all time.

In 1821 John Forbes made an English translation of Laennec's work and three years later followed it with a book containing selections from the writings of Auenbrugger, Corversart and Laennec.

There followed studies of diseases of the chest by Louis in Paris, Skoda and Rokitansky in Bohemia and Stokes in England. In America the work of Austin Flint, Sr. was as important as that of any of the men following Laennec, and Flint is now known as the American Laennec.

Austin Flint came from a long line of medical forbears. He began the practice of medicine in Boston at the age of twenty-one after graduating from Harvard Medical School. Within the next twenty-seven years he had practiced and taught in no less than six widely separated medical colleges in the United States. At the age of twenty-one he also began to record his medical experience and is reported to have left 16,922 folio pages of medical experiences written in his own hand.

Austin Flint is best remembered today by the eponym which bears his name, the Austin Flint murmur. This finding he first noted in 1860 and described it in detail in 1862 in *On cardiac murmurs* published in the American Journal of The Medical Sciences, 44: 29-54. The article is herein republished in its entirety.

Flint gives a complete description of this murmur and follows it by an explanation of its cause. Many years later Vaquez in his study of the heart, after reviewing all theories regarding the production of this murmur, finally accepts Flint's original theory as the most reasonable.

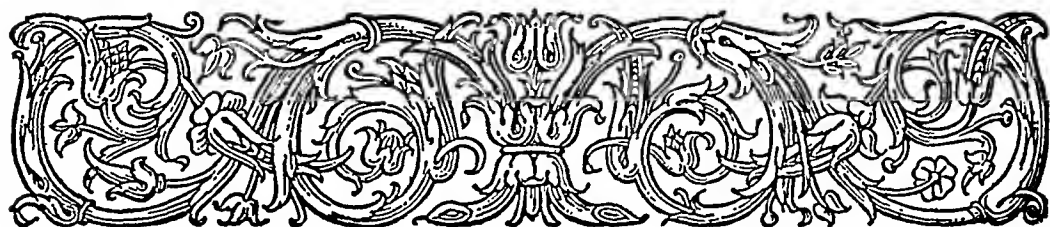
In addition to the description of the Flint murmur, Austin Flint performed great service to medicine by reason of his refinement of the diagnostic procedure of Auenbrugger and Laennec. Flint was one of the first to describe the increased resistance on percussion of pleural effusions. He gave a clearer description of pneumo-thorax than the great Laennec himself. He insisted that the prolonged expiratory sound must be attended by an elevation in pitch to be of diagnostic value in incipient tuberculosis. He made a careful study of all phases and types of breath sounds.

Austin Flint rose to occupy an important position in medicine. In 1881 he was appointed a delegate to the International Medical Congress in London and was elected an honorary Vice-President. He delivered an address entitled *The analytical study of auscultation and percussion, with reference to the distinctive characters of pulmonary signs*. This address is herein reproduced. Flint was then in his seventieth year and was a venerable practitioner who was looked up to by all doctors as a great authority on diagnosis of diseases of heart and lungs. He was elected to serve as President of the International Congress of Medicine in Washington in 1887 but death intervened. The paper of 1881 is therefore to be looked upon as his complete and mature contribution to the subject.

We can perhaps close this brief introduction to Flint and his important work in no better way than to quote the tribute written by his contemporary, Dr. Samuel D. Gross:

"Tall, handsome, and of manly form, with a well-modulated voice of great compass, he is a lecturer at once clear, distinct and inspiring. During his hour in the classroom no student ever falls asleep. He ranks high as a clinical instructor. As a diagnostician in diseases of the chest he has few equals. Nor is this fact at all surprising when we bear in mind the time and the immense labor which, from an early period of his professional life, he has devoted to their investigation. I know of no one who is so well entitled as Austin Flint, Sr. to be regarded as the American Laennec."





# On Cardiac Murmurs

BY

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**T**HE clinical study of cardiac murmurs, within the last few years, has led to our present knowledge of the diagnosis of valvular lesions of the heart. By means of the organic murmurs it is positively ascertained that lesions exist in cases in which, without taking cognizance of the murmurs, the existence of lesions could only be guessed at. The absence of the organic murmurs, on the other hand, enables us generally to conclude with positiveness that valvular lesions do not exist. As a rule, to which there are but few exceptions, these lesions may be excluded, if there be no murmur. These are great results; but the practical auscultator of the present day need not be told that the clinical study of cardiac murmurs has led still further into the mysteries of diagnosis. Having ascertained the different murmurs which occur in connection with valvular lesions; having traced their connection, respectively, with different lesions; having shown their relations to the movements of the several portions of the heart, and to the cardiac sounds;<sup>1</sup> and, having explained satisfactorily the mechanism of

<sup>1</sup> The conventional distinction between the cardiac *sounds* and *murmurs* is to be borne in mind; the former term being limited to the normal heart-sounds with their abnormal modifications, and the latter to newly-developed or adventitious sounds, which are altogether the products of disease.

their production, we are able to determine not only the existence or non-existence of valvular lesions, but their particular situation when they are present, and, to a certain extent, their character and consequences. The practiced auscultator, by listening to the murmurs alone, is able to tell whether lesions are situated at the mitral, or at the aortic, or at the pulmonic orifice, and he is able to say, in certain cases, that the valves which are to protect these orifices against a regurgitant current of blood, have been rendered by disease inadequate to their office. It is unnecessary to adduce proof of these statements; their correctness is sufficiently known to those who are conversant with physical exploration as applied to the diagnosis of affections of the heart. How strikingly do these facts exemplify the progress of practical medicine to those who, although still among the junior members of the profession, have practised before and since the recent developments in this department of our knowledge!

These remarks are introductory to the consideration of various practical points pertaining to the cardiac murmurs. And the first subject will relate to these murmurs in general—viz., the *limitations of their significance*. After having considered certain points embraced in this subject, I propose to take up various points relating to the different murmurs separately.

(p. 30) By the limitations of the significance of the murmurs, I mean the actual amount of knowledge respecting valvular lesions to be derived from this source. It is evident, from what has been stated already, that the knowledge which they convey is of very great importance, but, important as this knowledge is, it has certain limits which are not always sufficiently understood; and, as a consequence, the practitioner is liable to fall into unfortunate errors of opinion as regards the gravity of the lesions which the murmurs represent.

Prior to the clinical study of the cardiac murmurs, the existence of organic affections of the heart was recognized when, in conjunction with disturbed action of the organ, symptomatic events had taken place which belong to an advanced stage of only a certain proportion of cases. Dyspnea, palpitation, and dropsy, were the symptoms mainly relied upon for the diagnosis. The

recognized cases were then comparatively rare, and, when recognized, a speedily fatal issue was expected. This fact, together with the frequency with which cardiac lesions were revealed by post-mortem examinations in cases of sudden death, rendered the diagnosis of organic disease of the heart equivalent to a summons from the grave. The prognosis, as a matter of course, was as unfavorable as possible; the doom of the patient was either to die unexpectedly at any moment, or to endure protracted sufferings until released by death. The study of the murmurs, together with the application of other signs, enabled the practitioner to recognize organic affections at a period in the disease when otherwise they would not have been discovered. The recognized cases became more frequent. Persons were found to have cardiac lesions who presented few or no symptoms pointing obviously to disease of the heart. The ideas which had prevailed relative to the gravity of organic affections, however, naturally enough, continued to prevail. An organic murmur, consequently, had a fearful significance. It was considered as proof of disease which was not less surely destructive because earlier ascertained. Let it be said of a patient that he had a cardiac murmur denoting a valvular lesion, and his doom was pronounced; sudden death, which might occur at any time, or an early development of the distressing symptoms characteristic of cardiac disease, were to be expected, whatever might be his present condition.

So far from concealing from patients the fearful significance of cardiac murmurs, it was considered important for them to understand fully their precarious condition, in order to receive their co-operation in the measures of management which were deemed essential. These measures embraced general and local blood-letting, depletion by cathartics, sedative remedies addressed to the circulation, mercurialization, low diet, together with as much inaction of mind and body as possible. The consequences of this management were calamitous in the extreme. In fact, these measures contributed, in no small degree, to the fulfilment of the gloomy predictions impressed upon the minds of the unfortunate patients who were found to (p. 31) present the auscultatory sign of valvular lesions. So long as these notions with regard to the

treatment of cardiac affections prevailed, an early diagnosis, instead of being desirable, was a serious disadvantage, and truly fortunate were they who kept aloof from the stethoscope of the auscultator!

Erroneous views respecting the significance of cardiac murmurs, and also respecting the indications for treatment in cases of organic disease of the heart, are still, to a greater or less extent, prevalent. I propose now to confine myself to the former, i. e., the significance of the murmurs. It is obvious that with the acquirement of means of ascertaining the existence of lesions at an early period, when, without these means, the lesions could not have been discovered, clinical experience had to take a new point of departure as regards prognosis. And experience has shown that lesions giving rise to cardiac murmurs by no means invariably denote impending danger or serious evils, and that they are not unfrequently innocuous. Several clinical observers, within the last few years, have contributed facts going to show the correctness of this statement. Of these, Dr. Stokes<sup>2</sup> is especially prominent. Dr. Gairdner, of Edinburgh, has lately communicated a valuable paper on this subject<sup>3</sup>. I have been able to gather some facts having an important bearing on the subject under consideration. Of the cases which have come under my observation, exemplifying the "limitations of the significance of cardiac murmurs," I shall select a few of the most striking.

Thirteen years ago, I attended a child, aged 11 years, with a slight rheumatic attack. Directing attention to the heart, I found a very loud mitral, regurgitant murmur, heard over the left lateral surface of the chest and on the back. The heart was enlarged, the extent and degree of dulness in the precordia being increased, and the apex beat without the nipple. The murmur was evidently not due to an endocarditis developed during the present attack of rheumatism; the lesion giving rise to it probably originated in an obscure thoracic affection which had occurred seven years before. I was at that time less acquainted with the significance of cardiac murmurs than now, and I deemed it my

<sup>2</sup> Diseases of the Heart and Aorta.

<sup>3</sup> Edinburgh Monthly Journal of Med. Science.

duty to inform the mother of the patient of the existence of an organic affection of the heart, which would be likely to destroy life within a period not very remote. The patient is still living. She is now 24 years of age, and, although presenting a delicate appearance, a casual observer would not suspect the existence of any disease. She is subject to palpitation, to coldness of the extremities, and experiences want of breath on active exercise, but she does not consider herself an invalid, and the apprehensions caused by my communication to the mother have long since disappeared.

It is fair to presume that my opinion in this case was considered as a mistake. It was, indeed, an error of judgment as regards the prognosis, but the diagnosis was correct; the loud bellows murmur is still there, and (p. 32) heard over the whole chest, even through the dress, and the heart is considerably enlarged. The patient, if not destroyed by some intercurrent affection, will ultimately die of cardiac disease, yet it is now twenty years since the probable commencement of the lesions giving rise to the cardiac murmur.

Nearly twenty years ago a person was examined by a medical friend with reference to an assurance on his life. My friend, finding a loud murmur, and an abnormally strong action of the heart, brought the person to me as an interesting case for examination. I failed to record the case, and am not therefore positive as regards the particular murmur present, but I think it was the mitral regurgitant. Since that examination, until recently, I have been in the habit of meeting this person often, although he has never been my patient. He has been, and still is engaged in active business. He is now about fifty years of age. He has survived his wife, and been again married within a few years.

I have selected these two cases as illustrating the duration of life and comfortable health for thirteen and twenty years after a loud organic murmur, together with enlargement of the heart, had been ascertained; in both cases life and comfortable health continuing at the present moment. I could cite, in addition, numerous cases of persons now living, and apparently well, who

have had organic murmurs for several years. In making examinations of chests, supposed to be healthy, for purposes of study, I have repeatedly found a murmur, evidently organic, when no disease of the heart was suspected either before or after my examination. The following case is instructive, as showing the importance of taking into account the coexistence of functional disorder of the heart, dependent on anemia, with organic disease.

In November, 1852, I visited, in consultation with Professor Rogers, of Louisville, a lady aged about 25. She had had repeated attacks of acute rheumatism. She had an infant several months old, which she was nursing, and she had become quite anemic. She had begun to suffer from palpitation during the preceding summer, and her attention was attracted to a sound in the chest which she heard in the night-time. This sound was also heard by a sister with whom she slept. She described, of her own accord, the sound to be like that produced by a pair of bellows. She had never heard of cardiac bellows-murmurs, and at this time there had been no examination of the chest. Prof. Rogers had been called to the patient a short time before my visit, and detected at once the existence of organic disease.

She presented an aortic direct and a mitral regurgitant murmur, both loud; the heart was moderately enlarged, and its action violent. She was conscious of this violent action, and slight exercise or mental excitement occasioned much distress from palpitation. The urgent symptoms in the case were attributed to anemia; weaning was at once enjoined, and chalybeate remedies, etc., advised. I met the patient a year afterwards without recognizing her. She was apparently in perfect health, and presented a blooming appearance. Her friends thought we must have been mistaken in our opinion as to the existence of organic disease of the heart. The murmurs and the signs of enlargement, however, were still there. She (p. 33) continued to enjoy good health until the summer of 1856, when she suffered from uterine hemorrhage, and again became anemic. The action of the heart became irregular, and she complained much of vertigo. Tonics, stimulants, nutritious diet and fresh air failed to remove the anemic state, and at length she was seized with apoplexy and

duty to inform the mother of the patient of the existence of an organic affection of the heart, which would be likely to destroy life within a period not very remote. The patient is still living. She is now 24 years of age, and, although presenting a delicate appearance, a casual observer would not suspect the existence of any disease. She is subject to palpitation, to coldness of the extremities, and experiences want of breath on active exercise, but she does not consider herself an invalid, and the apprehensions caused by my communication to the mother have long since disappeared.

It is fair to presume that my opinion in this case was considered as a mistake. It was, indeed, an error of judgment as regards the prognosis, but the diagnosis was correct; the loud bellows murmur is still there, and (p. 32) heard over the whole chest, even through the dress, and the heart is considerably enlarged. The patient, if not destroyed by some intercurrent affection, will ultimately die of cardiac disease, yet it is now twenty years since the probable commencement of the lesions giving rise to the cardiac murmur.

Nearly twenty years ago a person was examined by a medical friend with reference to an assurance on his life. My friend, finding a loud murmur, and an abnormally strong action of the heart, brought the person to me as an interesting case for examination. I failed to record the case, and am not therefore positive as regards the particular murmur present, but I think it was the mitral regurgitant. Since that examination, until recently, I have been in the habit of meeting this person often, although he has never been my patient. He has been, and still is engaged in active business. He is now about fifty years of age. He has survived his wife, and been again married within a few years.

I have selected these two cases as illustrating the duration of life and comfortable health for thirteen and twenty years after a loud organic murmur, together with enlargement of the heart, had been ascertained; in both cases life and comfortable health continuing at the present moment. I could cite, in addition, numerous cases of persons now living, and apparently well, who

have had organic murmurs for several years. In making examinations of chests, supposed to be healthy, for purposes of study, I have repeatedly found a murmur, evidently organic, when no disease of the heart was suspected either before or after my examination. The following case is instructive, as showing the importance of taking into account the coexistence of functional disorder of the heart, dependent on anemia, with organic disease.

In November, 1852, I visited, in consultation with Professor Rogers, of Louisville, a lady aged about 25. She had had repeated attacks of acute rheumatism. She had an infant several months old, which she was nursing, and she had become quite anemic. She had begun to suffer from palpitation during the preceding summer, and her attention was attracted to a sound in the chest which she heard in the night-time. This sound was also heard by a sister with whom she slept. She described, of her own accord, the sound to be like that produced by a pair of bellows. She had never heard of cardiac bellows-murmurs, and at this time there had been no examination of the chest. Prof. Rogers had been called to the patient a short time before my visit, and detected at once the existence of organic disease.

She presented an aortic direct and a mitral regurgitant murmur, both loud; the heart was moderately enlarged, and its action violent. She was conscious of this violent action, and slight exercise or mental excitement occasioned much distress from palpitation. The urgent symptoms in the case were attributed to anemia; weaning was at once enjoined, and chalybeate remedies, etc., advised. I met the patient a year afterwards without recognizing her. She was apparently in perfect health, and presented a blooming appearance. Her friends thought we must have been mistaken in our opinion as to the existence of organic disease of the heart. The murmurs and the signs of enlargement, however, were still there. She (p. 33) continued to enjoy good health until the summer of 1856, when she suffered from uterine hemorrhage, and again became anemic. The action of the heart became irregular, and she complained much of vertigo. Tonics, stimulants, nutritious diet and fresh air failed to remove the anemic state, and at length she was seized with apoplexy and



hemiplegia. She recovered from the apoplexy, but the hemiplegia continued, and death took place between two and three weeks after the apoplectic seizure.

The significance of organic murmurs is limited to the points of information already stated in the introductory remarks, viz., the existence of lesions, their localization, and the fact of valvular insufficiency or regurgitation. Whether the lesions involve immediate danger to life, or, on the contrary, are compatible with many years of comfortable health, the murmurs do not inform us, nor do they teach us how far existing symptoms are referable to the lesions, and how far to functional disorder induced by other morbid conditions. Neither the intensity nor the quality of sound in the murmurs furnish any criteria by which the gravity of the lesions or their innocuousness can be determined. A loud murmur is even more likely to be produced in connection with comparatively unimportant lesions than with those of a grave character, because in the former, rather than in the latter case, is the action of the heart likely to be strong, and the intensity of the murmur, other things being equal, will depend on the force with which the currents of blood are moved. Whether the murmur be soft, or rough, or musical, depends not on the amount of damage which the lesions have occasioned, but on physical circumstances alike consistent with trivial and grave affections.

It may be imagined that these assertions, although true as regards murmurs produced by the direct currents of blood, do not hold good with respect to the regurgitant murmurs. The latter, it may be said, involving as they do insufficiency of the valves, will be loud in proportion to the amount of blood which regurgitates, and, therefore, the intensity of the murmur should be a criterion of the amount of valvular insufficiency. But clinical observation disproves this surmise. A minute regurgitant stream is as likely to be intensely murmuring as a large current, perhaps even more so. Here, too, the loudness of the sound will depend, in a great measure, on the power of the heart's action. To this point I shall recur when I come to consider the different murmurs separately.

The practical injunction to be enforced in connection with the

limitations of the significance of the cardiac murmurs is, that we are not to judge of the magnitude of valvular lesions, of the amount of danger on the one hand, or of the absence of danger on the other hand, by the characters belonging to the murmurs. The physician who undertakes to interrogate the heart by auscultation is not to decide that the condition of his patient is alarming, simply because he finds a murmur which he satisfies himself is dependent on an organic lesion of some kind. The lesion may be at that (p. 34) time, and perhaps ever afterwards, innocuous; the evils arising from cardiac affections may be remote, and so far from plunging the patient into despair by the announcement of the fact that he has an incurable disease of heart, there may be just grounds for holding out expectation of life and comfortable health for an indefinite period. Neither does it necessarily alter the case when more than one murmur is discovered; the existence of several murmurs by no means excludes the possibility of similar encouragement. We are to look to other sources of information than the murmurs in forming an opinion respecting the gravity of the affection. What are the sources of information on which our opinion is to be based? It does not fall within the scope of this essay to consider at length the points involved in the answer to this inquiry. I shall answer it in a few words.

The heart-sounds furnish means for determining whether the lesions are of a nature to affect materially the function of the valves. I must here pass by this useful and beautiful application of auscultation with a simple allusion to it, referring the reader elsewhere for a full exposition of the subject.<sup>4</sup> I shall, however, return to the subject presently in considering the murmurs individually. Means requiring less proficiency in physical exploration relate to enlargement of the heart. It is not a difficult problem to determine whether the heart be or be not enlarged, and it is easy to determine the degree of enlargement. Now, in general, if valvular lesions have not led to enlargement of the heart, they are not immediately dangerous, and the danger is

<sup>4</sup> Clinical Study of the Heart-sounds in Health and Disease, Prize Essay, Trans. Amer. Med. Association, 1859.

more or less remote. Here is a criterion of great importance in estimating the gravity, on the one hand, or the present innocuousness on the other hand, of lesions giving rise to murmurs. So long as the heart be not enlarged, the lesions cannot have occasioned to much extent those disturbances which arise from contraction or patency of the orifices. The murmurs, in themselves, give no information respecting the amount of obstruction from contracted orifices, or of regurgitation from valvular insufficiency. Let this fact be constantly borne in mind. But obstruction and regurgitation singly or combined, inevitably lead to enlargement of the heart; hence the latter becomes evidence of the former. The degree of enlargement is, in general, a guide to the extent and duration of the disturbances occasioned by contracted and patescent orifices. As a rule, if the heart be slightly or moderately enlarged, the immediate danger from the lesions which may give rise to one or more loud murmurs is not great.

The truth is, the evils and dangers arising from valvular lesions, for the most part, are not dependent directly on these lesions, but on the enlargement of the heart resulting from the lesions. We may go on a step further than this and say that, ordinarily, serious consequences of valvular lesions (p. 35) do not follow until the heart becomes weakened either by dilatation or by degenerative changes of tissue. So long as the enlargement be due mainly to hypertrophy of the muscular walls, the patient is comparatively safe. Hypertrophy is a compensatory provision, the augmented power of the heart's action enabling the organ to carry on the circulation in spite of the disturbance due to obstruction and regurgitation. Happily, in most cases, hypertrophy is the first effect of valvular lesions, and, for a time, it keeps pace with the progress of the latter. Dilatation, which weakens the heart's action, is an effect consecutive to hypertrophy, and, as a rule, it is not until the dilatation predominates that distressing and dangerous evils are manifested.

The practical bearing of these views respecting hypertrophy and dilatation, on the management of organic affections of the heart, is obvious. They are inconsistent with the employment of measures to prevent or diminish hypertrophy; on the contrary,

they point to the importance of an opposite end of management, viz., to encourage hypertrophy in preference to dilatation, and to maintain the vigour of the heart's action. It does not fall within the scope of this essay to consider therapeutical applications, and I must content myself with this passing notice of an immensely important reform in the management of organic affections of the heart.

Returning to the means of determining the gravity of valvular lesions, I repeat, they become serious, in other words, the distressing and dangerous symptomatic events are to be expected, in proportion as hypertrophy merges into dilatation, or as weakness of the organ may be induced by structural degeneration or other causes. In connection, then, with murmurs, we are to determine the condition of the heart as respects the points just mentioned, in order to estimate properly the gravity of the lesions which the murmurs represent. In leaving this subject, viz., the limited significance of the cardiac murmurs, I will give a case which is a type of a class of cases not unfrequently coming under observation.

In the spring of 1860, I was consulted by a medical gentleman from a distant State, who furnished me with the following written statement of his case:—

“About a year ago I went to the city of———to place myself under the care of Dr. ——, for a trifling surgical difficulty with which I had been annoyed for a long time. At long intervals previous to that time I had had severe pains in the left breast about the cardiac region, but at no time from any constant pain. I thought the pain was of a neuralgic character. While at —— I thought I would have my lungs examined, as some members of my family had been consumptive. I went to Dr. —— and to Dr. ——, both of whom pronounced my lungs sound, but said that my heart was affected. I came home much depressed by their opinion, and suffered so much from mental anxiety that in the course of a month or two I determined to go back and consult another medical gentleman, Dr. ——-. He told me that there was some roughness about the sounds of the heart but no serious organic disease. I was much relieved by this opinion, and

clung to the belief that the pains were of a neuralgic character. (Doubtless they were so.) Previous to my (p. 36) going to ——— I had all my life taken a good deal of out-door exercise, such as riding, hunting, fishing, etc. for the purpose of warding off any tendency to consumption. I have always had a frail figure and been inclined to despondency. I have suffered a great deal of anxiety, owing to family affairs and business matters. After my return from consulting Dr. ——— I thought it best to give up active exercise for fear of increasing any cardiac affection that might exist. I do not think that I have had any severe pain in my chest frequently, at any time, but only at intervals and apparently occasioned by anxiety about patients, etc.

“In December last I went into the country, 13 miles, to see a patient. The weather was very cold, rainy, and windy; I returned in the night. I was suffering from toothache and smoked a cigar in order to relieve the pain. I went over to my office to write a prescription for a sick child, and on my way back I was attacked with palpitation of the heart for the first time in my life. I came into the house and lay down, when I was seized with severe rigors without chills. I had also pain in the back and afterwards fever. Since then I have been subject, at intervals, to a jarring or knocking sensation about the heart, but no palpitation of long continuance. I cannot sleep as well on my left side as formerly, as it causes an uneasy sensation with something like palpitation and some pain. I do not take much exercise, and find that I get out of breath easily. I am very sensitive to cold. The attacks of increased action of the heart are always accompanied by rigors and irritability of the bladder. On the 19th of March, I was taken with a feeling of fatigue and indigestion, followed by severe rigors together with great heat of the head and body. The circulation was rapid and accompanied by palpitation. The attack lasted nearly an hour, and I feel the effect of it to-day, March 22d. I notice, when reading a newspaper or small book, that the action of the heart causes it to vibrate. During my first attack in Dec., I had an intermittent pulse. I did not recover from that attack so as to go out for a week, and have not since been as well as before.

"Fearing that my situation was critical I have been careful of myself. I have feared to increase the affection and that I might die suddenly. But I have had fear that in taking care of the cardiac affection I shall increase a tendency to consumption. Any mental anxiety increases the action of the heart. I do not smoke nor chew tobacco, nor drink any alcoholic liquors. I have suffered much from toothache; in other respects have had generally very good health. I have never had rheumatism. I am a married man with five children. I think my cardiac affection has been getting worse since December last, and I suffer in mind dreadfully on that account, as I have a great deal to live for."

On examination of the chest, in this case, I found the apex-beat in the 5th intercostal space half an inch within a vertical line passing through the nipple. The area of superficial cardiac dulness carefully delineated on the chest, was found to be of normal extent. The left border of the heart fell within the nipple. The respiratory murmur, on a deep inspiration, was heard over the whole precordia. The apex-beat was not abnormally strong; no other impulse was discovered, and no heaving of the precordia.

At the first examination, the heart being but little excited, I discovered a slight murmur just to the left of the apex, heard only during the latter part of each inspiratory act. I could discover no murmur at the base. At a subsequent examination on the same day, made after dinner, the patient having drank a little wine with his dinner, the action of the heart was much greater than at the previous examination. I then discovered a well marked systolic murmur at the apex, to the left of the apex and at the lower angle of the scapula; I also ascertained the existence of a soft systolic murmur at the base on the left side of the sternum and not on the right side. This murmur extended over the whole summit of the chest on the left side. At the summit it came evidently from the subclavian, as the (p. 37) pitch differed from that of the murmur over the pulmonary artery, i. e., in the 2d intercostal space on the left side.

On the next morning I made an examination while the patient

was still in bed. The heart was then acting tranquilly. I discovered a feeble murmur at the apex only; this murmur was not perceived behind, and no murmur was heard at the base.

The aortic and pulmonic second sounds were normal, and so also were the mitral and tricuspid valvular elements of the first sound.

I shall quote from my record book the remarks which were appended to this case when the record was made:—

“The heart is but little if at all enlarged, and the heart sounds are normal. There exist, therefore, no lesions which at present are of serious import. The cardiac trouble which has occasioned the patient so much unhappiness and anxiety, is purely functional.

“Dr. ——— (who first examined this patient) evidently discovered a murmur. His examination was not very critical, and was made after the patient had just mounted stairs at his hotel. The opinion that there was organic disease without any qualifying explanations produced a profound moral impression on the patient. The opinion of Dr. ——— subsequently did something toward relieving the apprehensions of the patient; but his coming such a long distance to consult me is evidence how much his mind was ill at ease on the subject.

“The heart is not entirely free from lesions; there is slight mitral regurgitation. The murmur at the base is perhaps inorganic, or at all events it does not denote important valvular lesions, since a comparison of the aortic and pulmonic sounds shows the two to be in a normal relation to each other. The lesions in fact which exist in the case are of no immediate seriousness, and of this I assured the patient in the most positive manner.

“This case affords an illustration of the importance of discriminating between functional disorder and the effects of organic disease when there is evidence of the latter. It illustrates, also, the importance of the heart sounds and of the size of the heart in determining the gravity of lesions. The evils which may arise from the lesions (if they ever occur) are remote, and I felt warranted in assuring the patient that his condition involved no present danger, and that he might dismiss all thoughts of disease

of the heart. I ordered him to live well and to resume his outdoor sports. His apprehensions were entirely relieved by my assurances, and his expressions of gratification afforded evidence of what he had suffered mentally from the idea of an organic disease incapacitating him for the duties of life and rendering him liable to sudden death."

As I have said, this case is a type of a class of cases of not unfrequent occurrence. The existence of a cardiac murmur was discovered in consequence of an examination with reference to the lungs. Prior to this time no symptoms of disorder of the heart existed; the discovery of the murmur was an unfortunate circumstance for the patient; the belief that he had serious disease of the heart became fixed in his mind, and doubtless contributed to the disorder which subsequently occurred. The functional disorder was slight in comparison with cases which are of daily occurrence; but the patient naturally attributed it to organic disease. The affection was in (p. 38) fact altogether functional, albeit the existence of an organic murmur; this is the practical point which the case is intended to illustrate.

I propose now to consider certain practical points pertaining to the cardiac murmur separately; I shall limit my remarks mainly to the murmurs produced by the blood-currents, in the left side of the heart, viz., *the aortic direct, the aortic regurgitant, the mitral systolic and the mitral direct*. Exclusive of the *pulmonic direct* murmur I have but little practical acquaintance with murmurs emanating from the right side of the heart.

*Aortic direct murmur*.—The question whether a murmur be organic or inorganic has reference generally to a murmur produced by the current of blood from the left ventricle into the aorta. The aortic regurgitant murmur and a mitral murmur which is truly regurgitant are of necessity organic; they require lesions involving more or less insufficiency of the valves. The mitral direct murmur, as will be seen presently, is inorganic only as a rare exception to the rule. A practical point, then, in certain cases, is to determine whether an existing aortic direct murmur be organic, i. e., dependent on lesions, or whether it be inorganic, i. e., dependent on a blood-change. This point cannot always be



positively settled, but when such is the case it is practically not very important that it should be settled; in other words, when a murmur exists concerning which we are at a loss to decide whether it be organic or inorganic, if it be the former, the lesion giving rise to it must be trivial, since under these circumstances the heart sounds will be found to be normal and the heart not enlarged. If in connection with an aortic direct murmur we find the aortic second sound impaired and the heart enlarged, we are warranted in considering the murmur organic. But a slight rippling of the current by roughening from an atheromatous or calcareous deposit which occasions no obstruction, and no valvular insufficiency, may yield a murmur. How are we to distinguish this from an inorganic murmur? The absence of the anemic state, of other cardiac murmurs, of arterial murmurs, of the venous hum, and the persistency and uniformity of the murmur are the circumstances which render it probable that it is organic; while the existence of anemia, of other cardiac murmurs, of arterial murmurs and the venous hum, together with intermittency and variableness of the murmur, render it probable that it is inorganic.

In my work on diseases of the heart, 1859, I have stated roughness of the murmur to be one of the circumstances showing it to be organic. I then believed that an inorganic murmur was never rough. The able reviewer of my work in the *Dublin Quarterly* says, with regard to this point, "We are unable to give unqualified assent to the statement that an inorganic murmur is uniformly soft." The criticism of the reviewer is just; I was mistaken in the statement as the following case will show:—

(p. 39) I visited in May 1860, a female patient who presented a loud rasping murmur which had led to the suspicion of aneurism. The patient was exceedingly anemic; there was total loss of appetite with vomiting and diarrhea. The anemia could not be accounted for; it belonged in the category of cases described by Addison as cases of idiopathic anemia. I found a rough rasping murmur at the base of the heart on the right side of the sternum, and a similar murmur was heard over the subclavian and carotid. On examination after death, in this case, the heart was perfectly

normal, the aortic orifice, the aorta, subclavians, and carotids were free from any morbid change, and the lungs were healthy. The murmur was evidently due to a blood change.

The discrimination of an aortic direct from a pulmonic direct murmur is a point of interest. If the normal situation of the aortic and pulmonic artery in relation to the walls of the chest be preserved, an aortic direct murmur has its maximum of intensity and may be limited to the point where the aorta is nearest the surface, viz., the second intercostal space on the right side close to the sternum. But the normal relation of the vessels to the thoracic walls is not infrequently changed when the heart becomes enlarged, or as a consequence of past or present pulmonary disease, and hence this murmur may be loudest or limited to the base on the left side of the sternum. The situation of the murmur or of its maximum, therefore, is not always reliable in the discrimination. A pulmonic direct murmur has its maximum or is limited to the second or third intercostal spaces on the *left* side close to the sternum, the artery being at these points nearest the surface, but, as just stated, an aortic direct murmur may be found to be loudest in this situation. If the heart be not enlarged or displaced by pressure from below the diaphragm, the chest not depressed, and the lungs are free from disease, the fact that a murmur has its maximum at or is limited to the right side of the sternum, is evidence of its being aortic rather than pulmonic, and *per contra*, the fact of a murmur having its maximum at or being limited to the left side of the sternum, is evidence of its being pulmonic rather than aortic. But the propagation of the murmur into the carotid is the most important circumstance in this discrimination. An aortic direct murmur, unless it be quite weak, is generally propagated into the carotid. A pulmonic direct murmur of course cannot be. Here attention to the pitch and quality of sound is called into requisition. It is to be determined that a murmur heard over the carotid is propagated from the aorta, not produced within the carotid. How is this to be determined? Very easily in most cases, by a simple comparison of the murmur as heard over the carotid and at the aortic orifice. If the murmur in the neck be a propagated murmur it will differ

from that at the base of the heart chiefly as regards intensity; the pitch and quality will not be materially changed. If it be rough or soft at the base of the heart, it will be the same in the neck; if the pitch be high or low at the base of the heart, it will be the same in the neck. On the (p. 40) other hand, a murmur produced within the carotid, will be likely, in the great majority of cases to differ in quality and pitch from a coexisting murmur at the aortic orifice.

In accordance with what has been stated with reference to the limitations of the significance of organic murmurs in general, an aortic direct murmur, when undoubtedly organic, alone affords little or no information respecting the nature and extent of the lesions which give rise to it. A comparison of the aortic with the pulmonic second sound of the heart enables us frequently to form an opinion as regards the amount of damage which the aortic valve may have sustained. The aortic second sound, in health, as heard in the right second intercostal space near the sternum, is more intense, and has a more marked valvular quality, than the pulmonic second sound as heard in a corresponding situation on the left side. Now, it is often easy to determine whether the intensity of the aortic second sound is diminished and its valvular quality impaired; and in proportion as this sound is abnormally altered in these respects, we may infer that the aortic valve is damaged. It is hardly necessary to say that, in order for this comparison to warrant the inference just stated, pulmonary disease must be excluded. A tuberculous deposit, for example, on the left side, may, by conduction, render the pulmonic apparently more intense than the aortic sound, the latter retaining its normal intensity; the same will occur from shrinking of the upper lobe of the left lung so as to bring the pulmonic artery into contact with the thoracic walls. Under the latter circumstances the pulsation of the pulmonic artery may sometimes be distinctly felt in the second left intercostal space near the sternum. I have met with two cases during the past winter in which the pulsation of the pulmonic artery was so strong as to suggest the idea of aneurism; in both cases the patients were affected with tuberculous disease of the left lung. Alteration of the normal relation

of the aorta and pulmonic artery due to enlargement of the heart, or to any of the causes already mentioned, will of course preclude a comparison of the two sounds.

With reference to the value of a comparison of the aortic and pulmonic second sound in estimating the amount of aortic lesions, the able reviewer in the *Dublin Quarterly*, to whom I have already referred, and for whose valuable criticisms I beg to avail myself of this opportunity of expressing my sincere thanks, remarks as follows:—

“It is observed, to our great wonder, that if the aortic second sound retain its normal intensity and purity, it shows that the aortic valve is competent to fulfil its function, *a fact which warrants the exclusion of lesions affecting it sufficiently to give rise to obstruction.*” He adds, “Surely Dr. Flint must have become clinically cognizant of the fact that there is not unfrequently serious contraction of the aortic orifice producing marked obstruction and hypertrophy of the left ventricle, the aortic second sound remaining intact.”

This criticism is not altogether just. I state that the normal intensity and purity of the aortic second sound warrant the exclusion of lesions affecting (p. 41) it, i. e., the valve, sufficiently to give rise to obstruction. I do not say that contraction of the aortic orifice may not occur without involving the aortic valve, and, in such a case, the aortic second sound may remain intact. In fact, I imply this when I proceed to say, “In a large proportion of the cases of obstructive lesions of the aortic orifice, the valve is involved sufficiently to compromise, to a greater or less extent, its function and impair the intensity of the aortic second sound.” This language is equivalent to admitting that there is a small proportion of cases of obstructive lesions of the aortic orifice, in which the valve is *not* involved sufficiently to compromise its function and impair the intensity of the aortic second sound. These exceptional cases are extremely rare. Surely the able reviewer will admit that, in the great majority of cases, the valve is involved so as to impair its function to a greater or less extent.

I have lately been interested in a nice point of observation connected with the murmur under consideration, viz., the concur-

rence of two aortic direct murmurs, one produced at the aortic orifice and another within the aorta just above the orifice. One of the murmurs may be organic and the other inorganic, or both murmurs may be organic. At the present moment I have under observation three cases of endocarditis with rheumatism, each presenting a high pitched basic murmur when the stethoscope is placed over the sternum and a little to the right of the median line, the murmur limited to a circumscribed space, and just above this point, in the right second intercostal space, is another murmur differing from the former notably in pitch, being quite low. In one of these cases there is still another murmur in the pulmonic artery. The high pitched murmur just below the second intercostal space, as I infer from the situation to which it is limited, is a murmur produced at the aortic orifice; and the low pitched murmur just above, as I infer, also, from the situation to which it is limited, is an aortic murmur produced within the artery above the aortic orifice. I infer that there are two murmurs from the notable difference in pitch, it being by no means probable that a single sound would be so much altered within the area in which the two murmurs are heard, this area not being larger than a half dollar. That an aortic murmur is sometimes produced at the orifice and sometimes within the artery above the orifice, in different cases, is certain, but I am not aware that the production of a murmur in each situation, at the same time, in the same case, and the discrimination of the two by means of the character of the sound, have been pointed out.

*Aortic regurgitant murmur.*—This murmur need never, as a matter of course, be confounded with the systolic murmurs, viz., the aortic direct, and mitral regurgitant, the latter occurring with the first, and the former with the second sound of the heart. In general, too, there is no difficulty in distinguishing the aortic regurgitant, from the mitral direct murmur. The former occurs with and follows the second sound, the latter precedes the (p. 42) first sound. The one is diastolic, the other is pre-systolic. This is a distinction, nice, it is true, but easily appreciable in practice, to which I shall recur under the heading of the mitral direct murmur.

The situation of the murmur is also distinctive. It is best heard at, and below the base of the heart. Usually it is best heard below the base to the left of the median line on a level with the third or fourth ribs. This is doubted by the reviewer in the *Dublin Quarterly*, to whom I have referred, but as the statement is based on a pretty large number of recorded observations, I must consider it as correct. It is not uncommon to hear this murmur distinctly, and even loudly, over the apex; it may be diffused over the whole precordia and even propagated beyond this region.

An aortic murmur with the second sound of the heart, propagated below the base of the heart, necessarily implies regurgitation, in other words there must be insufficiency of the aortic valvular segments. But it is always to be borne in mind that no inference can be drawn from the intensity or character of the murmur, respecting the amount of insufficiency and consequent regurgitation. An extremely small regurgitant stream may give rise to a loud murmur, while a feeble murmur may accompany a large regurgitant current, as the rippling brook is noisy while the deep broad river flows silently. In a case recently under observation, there existed a loud aortic regurgitant murmur, and on examination after death the aortic segments were so slightly impaired that, on cursory inspection, they might have been considered as normal. Weakening or extinction of the aortic second sound of the heart are points of importance as showing frequently the extent to which the function of the aortic valve is impaired. Comparison with the pulmonic sound enables us to judge whether the aortic sound be impaired, provided the pulmonic sound be not abnormally intensified as a result of coexisting mitral lesions. It is important to recollect that when aortic and mitral lesions coexist, the intensity of the pulmonic sound cannot be taken as a criterion for judging whether the aortic sound be, or be not weakened. This remark is equally applicable to the comparison in cases in which an aortic direct murmur is present. It is needless to say that in comparing the aortic and pulmonic sound in connection with an aortic regurgitant, as with an aortic direct murmur, pulmonary disease is to be excluded, i. e., solidification

or shrinking of the left lung will, as already stated, render the pulmonic sound relatively more intense than the aortic, irrespective of, on the one hand, any actual increase of the intensity of that sound, or, on the other hand, of any weakening of the aortic sound. It is also to be stated here, as heretofore, than an alteration of the situation of the aorta and pulmonary artery as regards the thoracic walls, due to enlargement of the heart, or other causes, will preclude a comparison of the two sounds with reference either to intensification of the pulmonic, or weakening of the aortic sound.

(p. 43) *Mitral systolic murmur*.—I use the phrase *mitral systolic*, instead of that more commonly used, viz., *mitral regurgitant* murmur, as applied to any murmur produced at the mitral orifice and accompanying the first sound of the heart. If the latter term be applied to any systolic murmur emanating from the mitral orifice, we fall into the solecism of calling a murmur regurgitant in cases in which there is no regurgitation. A mitral murmur may be produced by mere roughness of the valvular curtains when there is no insufficiency of the valve. In this case the murmur cannot be correctly said to be regurgitant. A mitral systolic murmur, thus, may or may not be a regurgitant murmur, and, to express this important distinction, we may say that a mitral systolic murmur exists with or without regurgitation. The question at once arises, how are we to determine whether a mitral systolic murmur be regurgitant or non-regurgitant? This point claims consideration.

A mitral systolic murmur, as is well known, generally has its maximum of intensity at, and the murmuring may be limited to, the situation of the apex-beat, or to the point where the intensity of the first sound of the heart is greatest. The murmur may be diffused, in the first place, within this point over the body of the heart, and, in the second place, without the apex over the left lateral surface of the chest and on the back. I have been led to believe that when the murmur is diffused over the left lateral surface and more or less over the back, it always denotes regurgitation, and that when the murmur is not propagated much without the apex, although it may be more or less diffused over the

body of the heart, it may be produced within the ventricle and not by a regurgitant current. In the latter case I have distinguished the murmur as an intraventricular murmur, and not considered it as affording any evidence of insufficiency of the mitral valve. It is this intra-ventricular, or mitral systolic non-regurgitant murmur, which generally exists in rheumatic endocarditis. The importance of the point involved is obvious, for a murmur emanating from the mitral orifice without valvular insufficiency or regurgitation, denotes lesions of little immediate consequence, and they may be innocuous, not only for the present but for the future.

The practical rule just stated, I believe, generally holds good; but there may be exceptions. The following is perhaps an exceptional instance: a case was recently under my observation in Bellevue Hospital, in which acute rheumatism was complicated with endocarditis, pericarditis, and pleurisy, with considerable effusion, affecting the left side. This patient presented, on admission, a loud pericardial friction sound diffused over the whole precordia, and a loud mitral systolic murmur. The latter had its maximum of intensity at the apex, but was diffused over the left lateral surface of the chest and heard on the back. After the lapse of about a week the friction sound disappeared; but before the disappearance of the friction sound, the endocardial murmur had gradually diminished and disappeared. (p. 44) The pleuritic effusion also disappeared, and evidence was afforded in this case of pericardial adhesions by the immobility of the apex-beat when the body of the patient was placed in different positions. The disappearance of an endocardial murmur developed by rheumatic endocarditis, so far as my observation goes, is rare, although I have met with other examples. I suppose that endocarditis does not involve actual regurgitation save as a remote consequence of lesions to which the endocarditis may give rise. I may be mistaken in this supposition, but, assuming that I am not, here was an instance in which an intra-ventricular or non-regurgitant mitral systolic murmur was propagated entirely around the chest.

With reference to determining the existence of either regurgi-



tation or obstruction, or both, resulting from mitral lesions, a comparison of the aortic and pulmonic second sound, forms a beautiful and useful application of auscultation. Obstructive and regurgitant lesions, situated at the mitral orifice, involving an obstacle to the free passage of blood through the pulmonary circuit, give rise, as is well known, to hypertrophy of the right ventricle. In this way they lead to intensification of the pulmonic second sound of the heart. This effect is due, in part, to the augmented power of the contractions of the right ventricle, and, in part, to the resistance to the passage of blood through the lungs, both continuing to increase the dilatation of the pulmonary artery by the pulmonic direct current, and the consequent recoil of the arterial coats by which the pulmonic valvular segments are expanded, and the pulmonic second sound produced. But the morbid disparity between the aortic and pulmonic second sound is due, not alone to the intensification of the latter in the manner just stated. The aortic second sound is weakened in proportion to the amount of blood which fails to pass into the aorta with the ventricular systole, in consequence of the mitral obstruction or regurgitation. It is obvious that the aortic direct current will be lessened by the amount of blood which, in consequence of valvular insufficiency, flows backward into the left auricle after the ventricle contracts, and by the amount of difficulty which exists in the free passage of blood from the auricle into the ventricle in consequence of a contracted orifice. It is also obvious that, other things being equal, the intensity of the aortic second sound will be greater or less according to the quantity of blood propelled into the aorta by the ventricular systole. Thus it is clear how mitral obstruction and regurgitation lead to weakening of the aortic sound, as well as to intensification of the pulmonic sound, and both effects are abundantly attested by clinical observation.

The degree of weakening of the aortic and of intensification of the pulmonic sound will be proportionate to the amount of mitral regurgitation or obstruction, or both. We have then, in this application of auscultation, a means of obtaining information respecting the extent or gravity of mitral lesions. And,

in a negative point of view, this application is important, viz., as a means of determining that lesions which give rise to a (p. 45) murmur are not serious; in other words, of determining that they do not involve much, if any, obstruction or regurgitation. As enabling us to exclude obstructive or regurgitant lesions in certain of the cases in which mitral murmurs exist, a comparison of the aortic and pulmonic sound is of great practical value. But the circumstances which may stand in the way of this application of auscultation are to be borne in mind. The two sounds cannot be compared with reference to mitral, more than with reference to aortic lesions, if there be coexisting pulmonary disease, nor whenever the normal relation of the aorta and pulmonary artery to the thoracic wall is altered by either past or present disease of lungs, by deformity of the chest, or any other cause. It is also to be recollected that mere enlargement of the heart may disturb the normal relation of these vessels to the walls of the chest. This application, moreover, cannot be made when mitral and aortic lesions coexist. Under the latter circumstances it is, of course, difficult or impossible to determine how far an existing disparity between the aortic and pulmonic sound is due to the aortic, and how far to the mitral lesions.

Another important point pertaining to a mitral systolic murmur is, its occurrence without any appreciable lesions. A truly mitral regurgitant murmur doubtless always involves lesions of some kind, for it is hardly probable that the papillary muscles, as has been supposed, may become spasmodically affected and thus give rise to insufficiency or regurgitation as a temporary functional disorder. But it is undoubtedly true that a systolic murmur either limited to, or having its maximum of intensity near the apex, has been repeatedly observed in cases in which mitral lesions were not apparent after death. Dr. Bristowe in a paper contained in the *Brit. and For. Med. Chir. Review*, for July, 1861, details six cases of this description. Dr. Barlow, in an article in *Guy's Hospital Reports*, vol. V., 1859, states that a mitral murmur may occur (for what reason he does not state) in long-continued capillary bronchitis. I have met with some

instances in which a systolic murmur, supposed to be mitral, existed, and no mitral lesions were found after death.

CASE 1.<sup>5</sup> In the winter of 1859-60, I saw a female patient in the Charity Hospital, New Orleans, in the service of my colleague, Prof. Brickell, affected with capillary bronchitis. After several days there was improvement as regards the pulmonary symptoms, and then, for the first time, a systolic cardiac murmur was discovered. The murmur was loudest at the epigastrium, but heard over the site of the apex, and extended to, but not above the base of the heart. The patient subsequently died. On examination after death the lungs were emphysematous; there were no valvular lesions, all the valves appearing to be sound. The foramen ovale was closed. There were no clots. The right ventricle was distended with liquid blood. The walls of the heart were of normal thickness. The valves and orifices were not measured, nor was the water test of valvular sufficiency employed.

(p. 46) In recording this case I have commented on the murmur as follows: "What could have caused the loud systolic murmur? I cannot say unless it was due to distension of the right ventricle and tricuspid regurgitation."

In support of the supposition that the murmur was tricuspid, not mitral, it is to be noted that the greatest intensity was at the epigastrium. It was, however, considered to be a mitral systolic murmur during life.

CASE 2.<sup>6</sup> During the winter of 1860-61, a patient was under my observation in the Charity Hospital, New Orleans, for four months, affected with albuminuria and general dropsy. During all this time there was a mitral systolic murmur heard at the apex and over the body of the heart, and not propagated without the apex. It was regarded as a mitral systolic, non-regurgitant or intra-ventricular murmur, and as such pointed out to several private classes in auscultation. The patient died by asthenia, and was found to have fatty kidneys and cirrhosis of the liver. On examination of the heart, post mortem, nothing abnormal

<sup>5</sup> Private Records, vol. xi, p. 36.

<sup>6</sup> Private Records, vol. xi, p. 243.

was found except some enlargement, the organ weighing 12 oz., and a little separation of the marginal extremity of two of the aortic segments. The mitral valve appeared to be perfectly normal. I expected to find some roughening of the mitral valve but no insufficiency; there was, however, no atheromatous, calcareous or other deposit, and the valve seemed to be sufficient. There was no aortic, nor pulmonic murmur in this case, a fact which excludes the supposition that the existing murmur was due to the condition of the blood.

CASE 3.<sup>7</sup> During the winter of 1860-61, a patient was under my observation in the Charity Hospital, New Orleans, for about six weeks, affected with chronic bronchitis and emphysema of lungs. He presented habitual dyspnea which was at times excessive, persisting lividity and anasarca. The heart was evidently somewhat enlarged. There was a loud rough systolic murmur, having its maximum of intensity at the apex propagated without the apex (the record does not state how far), and over the body of the heart. On examination after death the volume of the heart was not much increased, and its weight was 13 oz. The left ventricle was not dilated and the left auricle was small. The walls of the left ventricle did not exceed half an inch in thickness, and the appearance of the muscular tissue was healthy. The mitral valve was perfectly normal. The orifice was not enlarged, and the valve must have been sufficient. No lesion at the aortic orifice. The right cavities were much dilated. They were twice as large as the left cavities. The walls of the right ventricle were much thickened, the thickness falling but little short of that of the left ventricle. No lesion of the pulmonic orifice. The tricuspid valve was normal. The orifice was very large, admitting the extremities of all the fingers. I have appended to the record of this case the following comment: "Whence the murmur supposed to be a mitral regurgitant? I suspect it was a tricuspid regurgitant."

Dr. Bristowe, in the article already referred to, discusses several conditions which have been supposed to give rise to the

<sup>7</sup> Hospital Records, vol. xv, p. 423.

murmur in cases like those which have just been given, viz., clots in the ventricular cavity, spasm of the papillary muscles, and enlargement of the auricular orifice so as to (p. 47) render the valve insufficient. His own opinion is that the murmur is due to a "disproportion between the size of the ventricular cavity and the length of the chordae tendinae and musculi papillares." This disproportion he attributes to dilatation of the cavity of the ventricle. He also accepts to some extent an explanation offered by Dr. Hare, viz., that the murmur may be due to a "lateral displacement of the origins of the musculi papillares in consequence of the rounded form which dilatation imparts to the heart."

These several explanations may each be applicable to certain cases, but none of them, apparently, to the cases which I have given. Clots in the left ventricle were not present in either of the cases; the murmur continued too long and too persistently to be due to spasm; the mitral orifice was not dilated, and the enlargement of the heart was not sufficient to occasion a notable disproportion between the length of the tendinous cords and papillary muscles, and the ventricular cavity. I am disposed to think that in each of the three cases the murmur was erroneously considered to be mitral; that it was a tricuspid regurgitant murmur. As I have already said, I have but little practical knowledge of tricuspid murmurs. I have met with two instances in which murmur was connected with well-marked tricuspid lesions as verified by examination after death. In both these cases the murmur was heard over the body of the heart, within the superficial cardiac region. I suspect that a tricuspid regurgitant murmur is not so rare as is generally supposed, and that not very infrequently it is considered to be mitral. This opinion is expressed by Dr. Gairdner in an interesting article on cardiac murmurs in the *Edinburgh Med. Monthly*, Nov. 1861. According to this able clinical observer, a tricuspid systolic murmur is heard over the right ventricle where it is uncovered of lung, being but slightly audible above the third rib; and, if the heart be much enlarged, it may be heard louder towards the xiphoid cartilage. A collection of clinical facts respecting the

frequency of tricuspid murmurs, the physical conditions giving rise to them, and the means of discriminating them from mitral murmurs, is an important desideratum.

*Mitral direct murmur.*—This murmur is not recognized by many auscultators, and its existence is denied by some. It is generally confounded with a mitral systolic murmur. For many years after I had begun to devote special attention to cardiac affections, I committed this mistake, and I was sometimes puzzled to account for a supposed mitral systolic murmur rough at its beginning and soft at its ending. In my records of some cases before I had learned to separate the mitral direct from a mitral regurgitant, I have described the latter as presenting the variation just stated, the fact being that the two murmurs were present, the one rough and the other soft. It is only within the last few years that I have discriminated these two murmurs, but during this time my field of clinical observation has (p. 48) been so extensive that I have had abundant opportunities to make the discrimination. With regard to the frequency of the mitral direct murmur, it is by no means so rare as is generally supposed, and as I had thought some years ago. At one time during the past winter, in Bellevue Hospital, I knew of six examples of it, and several also at the Blackwell's Island Hospital. When the auscultator has learned to distinguish it, he will not be long in finding it if he be in the way of seeing a moderate number of cases of disease of the heart. From what has now been said, it is obvious that an important point pertaining to this murmur is, its discrimination from other murmurs. This point will first claim consideration.

In order to comprehend this murmur, it is essential to understand clearly when the mitral direct current of blood takes place. The opportunity of observing the movements of the heart exposed to view in a living animal conduces greatly to a clear understanding of this point. The mitral direct current is produced by the contraction of the auricles; now, when do the auricles contract? When the movements of the heart are observed, it is seen that the contraction of the auricles immediately precedes the contraction of the ventricles. So close is the connection

between the contraction of the auricles and the contraction of the ventricles, that the former appear to merge into the latter; there is no appreciable interval between the two, but the successive movements, although distinct, appear to be continuous. Moreover, it is evident to the eye, and to the touch, that the contractions of the auricles are not so feeble as some seem to suppose. The mitral direct current of blood, therefore, occurs just before the ventricular systole; it continues up to the ventricular systole, and must, of course, instantly cease when the ventricles contract. The contraction of the ventricles causing the first sound of the heart, it follows that the mitral direct current caused by the auricular contractions must take place just before the first sound; that it must continue to the first sound, and that it cannot continue an instant after the first sound.

The mitral direct murmur is produced by the mitral direct current of blood forced by the auricular contractions through a contracted or roughened mitral orifice. Hence, the facts just stated with regard to the current, apply to the murmur. The murmur occurs just before the ventricular systole or the first sound of the heart; it continues up to the occurrence of the first sound, and instantly ceases when the first sound is heard. It is not strictly correct to call this a diastolic murmur; it does not accompany the second or diastolic sound of the heart. The aortic regurgitant is the only true diastolic murmur. The mitral direct is a pre-systolic murmur; this name expresses its proper relation to the heart sounds, and it is the only murmur which does occur in that particular relation. The time of its occurrence as just explained, and as expressed by the term pre-systolic, is sufficient for its easy recognition when once it is fully comprehended. Although, when this murmur is fully comprehended, and has been repeatedly (p. 49) verified, it is more readily recognized than either of the other murmurs, there is often at first considerable difficulty in determining its existence. Let me endeavour to point out the way in which it may be ascertained. I have already said that by those who overlook this murmur it is generally confounded with the mitral systolic or regurgitant murmur. This is in consequence of its close connection with

the first sound, and because it is heard at and near the apex of the heart. Now it is evident that a mitral systolic murmur cannot commence before the ventricular systole. It is equally evident that the ventricular systole and the first sound of the heart are synchronous. It is, therefore, an absurdity to suppose that a mitral systolic or regurgitant murmur can be pre-systolic in the time of its occurrence. This murmur must necessarily accompany and follow the first sound of the heart, as clinical observation has established. We have, then, only to determine that a murmur is pre-systolic, and that it does not accompany the second sound of the heart (i.e., there is an appreciable interval of time between the second sound and the murmur), to recognize it as a mitral direct murmur. Generally it is sufficiently easy, after a little practice, to perceive that the murmur precedes the sound, but, if there be difficulty or doubt, there is a ready mode of rendering it apparent; this is by placing the finger on the carotid pulse. The carotid pulse is synchronous with the first sound of the heart, or, at least, so nearly synchronous, that there is no appreciable interval of time between them. Placing, then, the finger on the carotid and listening to the murmur at the apex, the murmur is found to occur before the arterial impulse and to cease instantly when the latter is felt.

The mitral direct murmur is to be discriminated from an aortic regurgitant murmur. These two murmurs may be confounded at first, but after a little practice the discrimination is easy. The aortic regurgitant murmur accompanies and follows the second sound of the heart. The mitral direct commences after the second sound. Generally there is a distinctly appreciable interval of time between the second sound and the commencement of the murmur. The aortic regurgitant murmur may be prolonged nearly or quite through the long pause up to the first sound; but the intensity of the murmur diminishes with the prolongation, the murmur being insensibly lost before or when the first sound occurs. The mitral direct murmur, on the contrary, always continues up to the first sound, and instead of losing any of its intensity, it becomes more intense, and appears to be abruptly arrested, in its greatest intensity, when the first



sound occurs. This is a striking characteristic. The difference in the situation in which two murmurs respectively are heard with their maximum of intensity, is another point in the discrimination. The aortic regurgitant murmur is generally heard at the base of the heart, and is heard loudest a little below the base near the left margin of the sternum on a level with the third intercostal space. The mitral direct murmur is heard loudest at or a little within the (p. 50) apex; is generally confined within a circumscribed space, not propagated much without the apex and rarely to the base of the heart.

The quality of the mitral direct murmur is, in many cases, characteristic. In my work on diseases of the heart I have said that this murmur is generally soft. My experience since that work was written has shown me that this statement is incorrect. The murmur is oftener rough than soft. The roughness is often peculiar. It is a *blubbery* sound, resembling that produced by throwing the lips or the tongue into vibration with the breath in expiration. I suppose that the murmur is caused, in these cases, by the vibration of the mitral curtains, and that the vibration of the lips or tongue by the breath represents the mechanism of the murmur as well as imitates the character of the sound. At one time I supposed this blubbery murmur denoted a particular lesion, viz., adhesion of the mitral curtains at their sides, forming that species of mitral contraction known as the *button hole slit*; but I have found this variety of murmur to occur without that lesion, and in fact, as will be seen presently, when no mitral lesion whatever exists.

A mitral direct murmur may, or may not, be associated with a mitral systolic murmur. Without having analyzed the numerous examples which I have recorded during the last few years, I should say that, while the mitral systolic murmur is much more frequent in its occurrence than the mitral direct, the former, indeed, being the most common of all the murmurs, the mitral direct is observed quite as often without, as with the mitral systolic. But the two frequently coexist, and then the demonstration of the existence of the mitral direct murmur may be made more striking than when it exists alone, provided, as is

usually the case, this murmur be rough and the mitral systolic murmur be soft. Listening at or near the apex in a case presenting a blubbering mitral direct and as oft mitral systolic murmur, the former, of course, precedes the latter, and between the two occurs the first sound of the heart, the apex-beat and the carotid pulse. The first sound, the apex-beat or the carotid pulse will be found to mark the abrupt ending of the mitral direct, and the beginning of the mitral systolic murmur. The different relations of the two murmurs to the first sound are distinctly perceived in such a case if the observer be prepared to perceive them by a clear comprehension of the subject. And when once the discrimination between the two murmurs has been fairly made, it becomes sufficiently easy; indeed, the mitral direct murmur is then more readily recognized than either of the other murmurs.

The existence of a mitral direct murmur has been theoretically denied on the ground that the auricular contractions are too weak to propel the current of blood with sufficient force to give rise to a sound. It is undoubtedly true that, other things being equal, the intensity of a murmur is proportionate to the force of the current, and clinical observation shows that sometimes a murmur is not appreciable when the heart is acting feebly, (p. 51) but becomes distinct when the power of the heart's action is from any cause increased. But murmurs do by no means always require for their production a powerful action of the heart; on the contrary, loud murmurs are often found when the heart is acting very feebly. For example, I have reported a case in which an aortic direct and an aortic regurgitant murmur were well marked in a patient an hour before death, the patient dying from paralysis of the heart due to distension of the left ventricle. Venous murmurs in the neck are often notably loud when, assuredly, the force of the current of blood in these veins is vastly less than the current from the auricles to the ventricles. The feebleness of the current in this instance is shown by the slight pressure requisite to interrupt it and arrest the murmur. It requires but little force of the expiratory current of air to throw the lips into vibration so as to produce a loud sound.

Moreover, one has only to see and feel the contractions of the auricle, when the heart is exposed in a living animal (the heart's action being much weakened under these circumstances) to be convinced that the power of these contractions is not so small as some seem to imagine; the blood is driven into the ventricles with considerable force. It is hardly necessary to say, however, that *à priori* reasoning with regard to the existence or non-existence of physical signs is not admissible. Clinical observation shows that a murmur does occur at the precise time when the mitral direct current takes place as shown by observation of the movements of the heart exposed to view in a living animal. And clinical observation shows that this murmur is not always feeble, but, on the contrary, is not infrequently notably loud.

So much for the reality of the mitral direct murmur and the means of discriminating it from other murmurs. It remains to consider another important practical point, viz., the pathological import of this murmur. As already stated, it is developed in connection with a contracted mitral orifice, and, so far as my experience goes, especially in connection with contraction caused by adherence of the mitral curtains, forming the *button hole slit*; the murmur, then, being due, not to the passage of blood over a roughened surface, but to the vibration of the curtains. And the sound, as thus produced, is peculiar, resembling the sound which may be produced, in an analogous manner, by causing the lips to vibrate with an expiratory puff. The murmur, however, may be produced by the flowing of the current of blood over a roughened surface, without contraction of the aperture. This is undoubtedly rare. As a rule, the force of the mitral direct current is not sufficient to develop a murmur unless there be mitral contraction. Is this murmur ever produced without any mitral lesions? One would *à priori* suppose the answer to this question to be in the negative. Clinical observation, however, shows that the question is to be answered in the affirmative. I have met with two cases in which a well-marked mitral direct murmur existed, and after death in one of the cases no mitral lesions were (p. 52) found; in the other case the lesion was insignificant. I will proceed to give an account of these cases, and then endeavor to explain the occurrence of the murmur.

CASE 1.<sup>8</sup> In May, 1860, I examined a patient, aged 56, who had had repeated attacks of palpitation, sense of suffocation, with expectoration of bloody mucus and a feeling of impending dissolution, but without pain, the paroxysms resembling angina, excepting the absence of pain. In the intervals between these attacks he was free from palpitation, did not suffer from want of breath on active exercise, and considered himself in good health. He had never had rheumatism. On examination of the chest, the heart was found to be enlarged, the enlargement being evidently by hypertrophy. At the apex was a pre-systolic blubbering murmur, which I then supposed to be characteristic of the button hole contraction of the mitral orifice. At the base of the heart was an aortic regurgitant murmur, which was diffused over nearly the whole precordia. There was no systolic murmur at the base or apex. Three days after this examination the patient was attacked with another paroxysm, and died in a few moments after the attack, sitting in his chair. The heart was enlarged, weighing  $16\frac{1}{2}$  oz., the walls of the left ventricle measuring  $\frac{1}{4}$ ths of an inch. The aorta was atheromatous, and dilated so as to render the valvular segments evidently insufficient. The mitral valve presented nothing abnormal, save a few small vegetations at the base of the curtains, as seen from the auricular aspect of the orifice.

In this case it is assumed that the mitral direct murmur, which was loud and of a blubbering character, was not due to the minute vegetations which were found after death. There was no mitral contraction. The mitral valve was unimpaired, so that the murmur could not have been due to mitral regurgitation.

CASE 2.<sup>9</sup> In February, 1861, I was requested to determine the murmur in a case at the Charity Hospital, New Orleans. I found an aortic direct and an aortic regurgitant murmur, both murmurs being well marked. There was also a distinct pre-systolic murmur within the apex, having the blubbering character. On examination after death, the aorta was dilated and roughened with atheroma and calcareous deposit. The aortic segments were contracted, and evidently insufficient. The mitral

<sup>8</sup> Private Records, vol x, p. 713.

<sup>9</sup> Private Records, vol. xi, p. 241.

curtains presented no lesions; the mitral orifice was neither contracted nor dilated, and the valve was evidently sufficient. The heart was considerably enlarged, weighing  $17\frac{1}{2}$  oz., and the walls of the left ventricle were an inch in thickness.

In the second, as in the first of the foregoing cases, it is evident that a mitral systolic murmur was not mistaken for a mitral direct murmur, for in both cases, the conditions for a mitral systolic murmur were not present. In both cases the mitral direct murmur was loud and had that character of sound which I suppose to be due to vibration of the mitral curtains. In both cases, it will be observed, an aortic regurgitant murmur existed, and aortic insufficiency was found to exist post mortem. How is the occurrence of the mitral direct murmur in these cases to be explained? I shall give an explanation which is to my mind satisfactory.

(p. 53) The explanation involves a point connected with the physiological action of the auricular valves. Experiments show that when the ventricles are filled with a liquid, the valvular curtains are floated away from the ventricular sides, approximating to each other and tending to closure of the auricular orifice. In fact, as first shown by Drs. Baumgarten and Hamernik, of Germany, a forcible injection of liquid into the left ventricle through the auricular opening will cause a complete closure of this opening by the coaptation of the mitral curtains, so that these authors contend that the natural closure of the auricular orifices is effected, not by the contraction of the ventricles, but by the forcible current of blood propelled into the ventricles by the auricles. However this may be, that the mitral curtains are floated out and brought into apposition to each other by simply distending the ventricular cavity with liquid, is a fact sufficiently established and easily verified. Now in cases of considerable aortic insufficiency, the left ventricle is rapidly filled with blood flowing back from the aorta as well as from the auricle, before the auricular contraction takes place. The distension of the ventricle is such that the mitral curtains are brought into coaptation, and when the auricular contraction takes place the mitral direct current passing between the curtains throws them into

vibration and gives rise to the characteristic blubbery murmur. The physical condition is in effect analogous to contraction of the mitral orifice from an adhesion of the curtains at their sides, the latter condition, as clinical observation abundantly proves, giving rise to a mitral direct murmur of a similar character.

A mitral direct murmur, then, may exist without mitral contraction and without any mitral lesions, provided there be aortic lesions involving considerable aortic regurgitation. This murmur by no means accompanies aortic regurgitant lesions as a rule; we meet with an aortic regurgitant murmur frequently when not accompanied by the mitral direct murmur. The circumstances which may be required to develop, functionally, the latter murmur, in addition to the amount of aortic regurgitation, remain to be ascertained. Probably enlargement of the left ventricle is one condition. The practical conclusion to be drawn from the two cases which have been given is, that a mitral direct murmur in a case presenting an aortic regurgitant murmur and cardiac enlargement, is not positive proof of the existence of mitral contraction or of any mitral lesions. The co-existence of a murmur denoting mitral regurgitation, in such a case, should be considered as rendering it probable that the mitral direct murmur is due to contraction or other lesions, and not functional.

Dr. Gairdner, in a recent article already referred to, proposes a change of name for the mitral direct murmur. He proposes to call it an auricular systolic murmur. Inasmuch as the murmur is produced by the systole of the left auricle, this name is significant. And the usual name is open to this criticism, viz., it is not produced by the whole of the mitral direct current, but only that part of the current which is caused by the contraction (p. 54) or systole of the auricle. From the situation of the auricles as regards the ventricles, the former being placed above the latter, and the free communication by means of the auriculo-ventricular openings, the blood must begin to flow from the auricles into the ventricles the instant the ventricular contractions cease. During the first part of the long pause or interval of silence, i. e., the period after the second sound and before

the subsequent first sound of the heart, the blood flows from the auricles into the ventricles simply in obedience to gravitation. It is not ascertained that this part of the current ever gives rise to a murmur. If it does, the murmur would follow immediately the second sound, or when an aortic regurgitant murmur occurs. I have conjectured that such a mitral direct murmur may occur, and that it is confounded with an aortic regurgitant murmur. This conjecture is based on cases in which an apparent aortic regurgitant murmur existed, and the aortic valves seemed to be nearly or quite sufficient on examination after death. However this may be, the mitral direct current giving rise to the murmur which has been considered in this article, is not the current which immediately follows the second sound, and is due to gravitation alone, but it is the current immediately preceding the ventricular systole, and due to the systole of the auricle. Hence, as it seems to me, the name proposed by Dr. Gairdner, being more specific and accurate, is to be preferred to that in common use.


THE END.

# The Analytical Study of Auscultation and Percussion, with Reference to the Distinctive Characters of Pulmonary Signs

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 AN OFFERING of homage to the memory of Laennec is a fitting introduction to a paper having for its aim promotion of our knowledge of physical diagnosis.

Laennec was not the first to listen for intra-thoracic sounds. Mention is made in the writings of Hippocrates of at least one auscultatory physical sign; and the prophetic intimation of Robert Hook, in 1705, has been often quoted.<sup>1</sup> Doubtless hundreds, before the time of Laennec, had applied the ear to the thorax, and heard pulmonary as well as cardiac sounds. But it was reserved for Laennec to study these sounds in order to discover the physical signs of different diseases, and by prosecuting this study to create an important epoch in the history of medicine.

<sup>1</sup> "Who knows but that one may discover the works performed in the several offices and shops of a man's body by the sound they make, and thereby discover what instrument or engine is out of order."



Homage is also due to the author of the work entitled, "A new Method for the Recognition of Internal Diseases of the Chest by the Percussion of this Cavity," which appeared more than half a century before the publication of Laennec's treatise on auscultation. It does not detract from the honour which belongs to Auenbrugger, that an adequate recognition of the value of the method of examination which he originated, followed, and was in a great measure attributable to, the labours of Laennec in behalf of auscultation.

The zeal and the industry as well as the genius of Laennec are evidenced by the accuracy of his descriptions of auscultatory phenomena, and by the fact that the verity of the physical signs which he discovered has, in the main, been confirmed by subsequent observers in all countries. That he should have cultivated this field of study so thoroughly as to gather all the products which it is capable of producing, was not to have been expected. The marvel is that he was able to render it so productive by his own labours during his short life. It is no disparagement to say that he was led into some errors, that his mode of study was in certain respects defective, and that parts of the field were left uncultivated.

Since the time of Laennec much has been added to our knowledge of auscultation and percussion. It must be said, however, that the enlargement of the scope and the increase in the precision of their application to diagnosis, have not been commensurate with the study given to them, and with the space which they have filled in medical literature. A considerable share of the attention which they have received has been directed to the mechanism of physical signs—a highly interesting branch of inquiry, but not essential to the practical utility, and involving much liability to error. The number of signs has by some writers been needlessly increased. There have been over-refinements of description and of interpretation. The nomenclature has been open to criticism. Names have not been used by different writers with uniformity as regards signification. The names applied to some signs have conveyed not merely imperfect but erroneous ideas. Some writers have even designated signs by

the names of authors who have described them. Hence it is that the study of auscultation and percussion, and their practical employment in diagnosis, have seemed to involve peculiar difficulties, and to be necessarily restricted to a few practitioners. It is common enough for physicians to say, without any sense of self-reproach, that they do not profess to be adepts in physical diagnosis, and to consider with complacency that it properly belongs to a specialty. As opposed to this view, I claim that by a simple method of study, which, for the sake of distinction, I have called analytical, the characters distinctive of physical signs are rendered clear, precise, and readily appreciable, so that the practical advantages of auscultation and percussion may be made available in diagnosis with a moderate amount of time and attention on the part of the student and the practitioner.

By the analytical method of study, I mean the analysis and comparison of physical signs in respect of the few obvious points of difference by which, practically, musical and other sounds are commonly discriminated. The most important of these points of difference relate to the intensity, the pitch, and the quality of sounds. It is unnecessary to define these terms, except to say that under the name quality I include all the differences in character which are exclusive of pitch and intensity. The innumerable variations embraced under the name quality, as thus defined, may be illustrated by the diversities of the human voice. Of many thousand persons, few, if any, are to be found with voices so alike as not to be distinguishable from each other, aside from differences relating to pitch and intensity. In the study of the signs furnished by auscultation and percussion, the differential points, in addition to those pertaining to intensity, pitch, and quality, are few and easily appreciated. They relate to apparent distance from, or nearness to, the ear, moisture or dryness, the rhythmical succession and the interruption of the continuity of sounds.

It is to be assumed that morbid physical signs represent morbid physical conditions, and not disease—that is, they are diagnostic of the latter only in so far as the physical conditions which they represent are characteristic of particular diseases. It is also to

be assumed that the sole reliable basis of our knowledge of the significance of the signs is experience. Certain morbid signs denote particular abnormal morbid conditions, because the former are found to be constantly associated with the latter. The only solid foundation of the knowledge which underlies the practical application to diagnosis of auscultation and percussion, therefore, is in clinical and autopsical observations. It is, of course, desirable to ascertain the mechanism of the signs, but it is by no means a *sine qua non* in order to establish their validity. For example, is the so-called bronchial respiration due to consonance, according to the theory of Skoda; or is it produced by the current of air within the bronchial tubes, as held by Laennec; or is it the laryngo-tracheal respiration conducted by the solidified lung? These questions need not be answered in order to appreciate the significance of the sign, or to recognize it by means of its distinctive characters. To infer from the acoustic characters of signs that, according to the laws of physics, certain morbid conditions must exist, or, on the other hand, to determine *à priori* the signs which should be represented by certain conditions, has proved, and will continue to prove, a source of fallacies. The endeavor to make the laws of acoustics the basis of the clinical significance of physical signs, has tended, as it seems to me, to retard not a little the advancement and diffusion of the practical knowledge of auscultation and percussion. Basing the significance of signs on experience, the analytical method of study protects against fallacies which must occur if it be assumed that the abnormal sounds contain intrinsic evidence of the nature of the physical conditions which they represent, or if it be considered indispensable to ascertain fully the mechanism of signs. By attempting to deduce the significance of sounds from their acoustic characters, the play of the imagination and the bias of preconceived notions cannot fail to lead to error.

It is a trite statement that the point of departure for the study of morbid physical signs is the study of healthy signs, inasmuch as the former are either deviations from, or additions to, the latter. But it may not be amiss to state, as a conclusion resulting from an experience of more than a quarter of a century

in practical teaching, that neglect of a proper study of healthy signs is the secret of the failure of many who undertake to master auscultation and percussion. Moreover, knowledge of the characters of the more important, and the most difficult to master, of the morbid respiratory and vocal signs, is already obtained when a thorough study has been made of the sounds produced by respiration and the voice over the larynx and trachea, over an area on the chest corresponding to the primary and secondary bronchi, and over the remainder of the thorax.

Proceeding, after these preliminary remarks, to consider the physical signs furnished by auscultation and percussion as determined and differentiated by analytical study, a natural division of the auscultatory signs is referable to, 1st, respiration; 2nd, the loud voice and speech; and 3rd, the whispered voice and speech. Having considered the signs belonging to these divisions, it will remain to consider the signs produced by percussion.

#### SIGNS REFERABLE TO RESPIRATION

The number of morbid respiratory signs which require nicety of discrimination is not large. They are among the signs grouped as abnormal modifications of the normal sounds. The adventitious sounds or râles are readily discriminated. The chief cause of confusion and difficulty, as regards the latter signs, has been a needless redundancy of them. The list need not extend beyond the crepitant and the sub-crepitant râle, the coarse and fine moist bronchial or bubbling râles, the sibilant and the sonorous dry bronchial râles, pleural friction sounds, gurgling and splashing sounds, amphoric respiration, and metallic tinkling. These signs are readily recognized and differentiated; there is no fault to be found with the names, and the significance of each has been sufficiently established. Of the signs belonging to the group of the abnormal modifications of the normal sounds, suppressed, simply weakened, and interrupted respiratory murmur require no analysis. The remainder of the signs in this group claim analytical study. The latter signs are as follows: 1. Bronchial respiration; 2. Gradatory combinations of the bronchial respiration and the normal respiratory or vesicular murmur, which I

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include under the name broncho-vesicular respiration; 3. Cavernous, broncho-cavernous, and caverno-vesicular respiration; and 4. Prolonged expiration.

Under the name bronchial respiration, Laennec embraced the normal laryngeal and tracheal respiration, together with the morbid respiratory sign representing solidified lung. He considered them all as essentially identical; and that they are so, is easily demonstrated by analysis and comparison. He distinguished the morbid sign from the normal respiratory murmur by the absence of what he called the slight crepitation, which is characteristic of the inspiratory sound in the normal respiratory murmur—the absence, in other words, of its vesicular quality,—by dryness, and by a sensory impression as if the air passed into a large empty space. Laennec did not compare auscultatory sounds in respect of pitch. Skoda, Walshe, Barth, and Roger, in the early editions of their works, made mention of pitch in comparing bronchial respiration with the normal respiratory murmur, without apparently attaching to it much importance. With these exceptions, comparisons in respect of pitch had not, so far as I know, entered into the descriptions of respiratory signs by writers in different countries, prior to thirty years ago, when I was led to the analytical study of these signs with special reference to variations in this respect. The results were published in the “Transactions of the American Medical Association” in 1852.<sup>2</sup> I hope not to incur the charge of having exceeded the bounds of modesty in claiming, by my studies at that time and subsequently, to have established, on the basis of variations in pitch, characters by which these and other respiratory signs may be positively and easily differentiated.

The normal respiratory murmur and the bronchial respiration may be considered as extremes between which are abnormal modifications other than those pertaining to the latter morbid sign. The differential characters of intermediate signs are to be determined by analytical study and comparison with those of the normal respiratory murmur, on the one hand, and, on

<sup>2</sup> Prize Essay on Variations of Pitch in Percussion and Respiratory Sounds, and their Application to Physical Diagnosis.

the other hand, with those of bronchial respiration. As a preliminary step, the normal respiratory murmur and bronchial respiration are to be contrasted in respect of the characters of each as ascertained by analysis.

The inspiratory sound in the normal respiratory murmur is of variable intensity in different persons. Intensity, therefore, does not enter into its characteristics. Its pitch is low, and its quality, for lack of a better term, may be called vesicular. The vesicular quality is *sui generis*. It cannot be described by words, and a distinct apprehension of it cannot be given by any analogy. The expiratory sound is continuous with the inspiratory, in natural breathing; it is still lower in pitch, much shorter, and the quality is neither vesicular nor tubular. Its quality may be expressed by calling it a simple blowing sound.

In contrast to these characters of the normal respiratory murmur, the inspiratory sound in bronchial respiration is high in pitch and tubular in quality, its intensity, like that of the inspiratory sound in the normal respiratory murmur, being variable, and therefore not entering into the distinctive characters of the sign. The expiratory sound, separated from the inspiratory sound by a brief interval, is higher in pitch than the inspiratory sound, tubular in quality, usually more intense, and its duration is equal to or longer than that of the inspiratory sound.

Bronchial respiration is the respiratory sign of complete or considerable solidification of lung. Now, between a degree of solidification sufficient to give rise to bronchial respiration and the normal condition of lung, gradations in solidification are involved in different diseases, and in different stages of the progress of certain diseases. Pneumonia and phthisis are familiar examples of diseases involving these gradations. As regards the abnormal modifications of respiration caused by a slight or a moderate degree of solidification, there is not a little vagueness and confusion; the respiratory sounds have been called rude, rough, harsh, sharp, and dry. These terms convey not only indefinite but erroneous ideas. As an illustration of incongruity, a cardiac bellows murmur is distinguished as soft, whereas a similar sound produced by respiration would be called rude. Supplementary



or puerile respiration is harsher in quality than the sound which represents moderate solidification of lung. A late German author of a work on diagnosis, which has been translated into the English and the French languages, includes, under the name hyper-vesicular, the sign called by others rude, rough, harsh, &c., whereas a distinctive feature of this sign is diminution of the vesicular quality of the inspiratory sound.<sup>3</sup> The lack of a clear apprehension of the characters distinctive of the sign is implied in the term indeterminate (unbestimmt) applied to it by Skoda, and still used by German writers.<sup>4</sup> I have proposed, as already stated, for the sounds representing gradations of solidification of lung falling short of the degree represented by bronchial respiration, the name broncho-vesicular respiration. This term expresses what analysis teaches—namely, a combination of the characters of bronchial respiration with those of the normal respiratory murmur. In broncho-vesicular respiration the inspiratory sound is both vesicular and tubular. The vesicular quality, always less than in health, is more or less diminished, and the tubular quality is more or less marked in proportion to the degree of solidification. The pitch is raised in proportion as the tubular quality predominates over the vesicular. The intensity is not important. The pitch, tubular quality, and length of the expiratory sound are in correspondence with the characters of the inspiratory sound. If in the inspiratory sound the vesicular quality predominate over the tubular, the expiratory sound is but little prolonged, its tubularity is not marked, and the pitch is but moderately raised; on the other hand, if in the inspiratory sound the tubular quality predominate over the vesicular, the expiratory sound is more prolonged, its tubularity is more marked,

<sup>3</sup> Guttman.

<sup>4</sup> Guttman states that as indeterminate respiratory sounds cannot be compared with any other known sounds, it is impossible to describe them. The advantage of the analytical method of study is shown by the facility with which they are described by the characters pertaining to the pitch and quality of the inspiratory and of the expiratory sound. The endeavour to explain the mechanism leads this author into error as regards the significance of the so-called indeterminate sounds. Their significance is rationally understood when it is considered that they are not indeterminate sounds, but sounds intermediate between the normal respiratory murmur and bronchial respiration.

and the pitch is higher. According to this description, a broncho-vesicular respiration may approximate closely to the bronchial, the chief distinction consisting in an appreciable vesicular quality in the inspiration; or, it may approximate to the normal respiratory murmur, the distinction consisting in the presence of an appreciable tubular quality. There are gradatory combinations between these extremes, as regards the relative proportion of the bronchial and the vesicular characters. As regards the significance of the sign, the solidification is greater in proportion as the characters of the sign approximate to those of bronchial respiration, and the amount of solidification is small in proportion as the characters approximate to those of the normal respiratory murmur. The intermediate gradatory combinations are exemplified during the stage of resolution in acute lobar pneumonia. The practical value of the sign in that connection is obvious. The sign is still more valuable in cases of phthisis and other pulmonary affections which involve slight or moderate degrees of solidification, either diffused or circumscribed. This sign enables the auscultator, not only to recognize the existence and the limits of solidification when not sufficient to give rise to bronchial respiration, but to ascertain whether the solidification be moderate or slight.

The distinctive characters of the broncho-vesicular respiration may be studied by auscultation of the chest in health. It has been customary to apply to the modifications of the respiratory murmur, as heard over the primary and secondary bronchi, the name normal bronchial respiration. This term is a misnomer. The respiratory sounds in this situation are never purely bronchial, but they have the bronchial and the vesicular characters combined. An appropriate name, therefore, is the normal broncho-vesicular respiration. I need not add that the characters of this normal broncho-vesicular respiration are more marked on the right than on the left side of the chest; the area within which they are confined being the sternal portion of the infra-clavicular and the upper part of the interscapular regions.

Cavernous respiration was described by Laennec as having essentially the characters of bronchial respiration, the only

difference being a sensory impression of air entering a larger space. Subsequent authors have generally held that these two signs are not to be differentiated by intrinsic differences. Skoda affirms that they are absolutely identical, and in this he is followed by the most recent of German publications. The nearest approach to the characters distinctive of the cavernous respiration is the description of Walshe, in the early as well as the late editions of his work on diseases of the lungs.

The analytical study of respiratory signs led me to recognize well-marked and easily-recognizable characters distinctive of cavernous respiration as long ago as 1852.<sup>5</sup> This sign is to be differentiated, on the one hand, from bronchial respiration, and on the other hand, from the normal respiratory murmur. The differential characters are as follows: The inspiratory sound, as compared with that of bronchial respiration, is low in pitch and non-tubular; as compared with that of the normal respiratory murmur, it is non-vesicular. It has a simple blowing quality. The expiratory sound differs from that of bronchial respiration in being low in pitch and devoid of tubular quality. The pitch is lower than that of the inspiratory sound. In pitch and quality it resembles the expiratory sound in the normal respiratory murmur. These characters, limited to a circumscribed space, without the boundaries of which is often found either bronchial or broncho-vesicular respiration, are readily appreciated, and they point unmistakably to the site of a cavity. The characters are so distinctive that the sign cannot be confounded with either bronchial or broncho-vesicular respiration. The liability to error is in confounding cavernous respiration with simply weakened respiratory murmur, the only essential point of distinction being the presence of vesicular quality in the normal inspiratory sound, and the absence of this quality in the cavernous inspiration; hence, if the respiratory murmur within a circumscribed space be so weak that the vesicular quality is not clearly appreciable, it cannot be distinguished from feeble cavernous respiration. The associated vocal sounds should always prevent this error.

<sup>5</sup> Vide Prize Essay: "Trans. American Med. Association," 1852.

Cavernous respiration is not infrequently modified by solidification of lung surrounding or situated in proximity to cavities. A combination of the bronchial and the cavernous characters is sometimes rendered apparent within a circumscribed area by comparison with a purely bronchial or a broncho-vesicular respiration without the limits of this area. This modification may be distinguished as broncho-cavernous respiration. A cavity without adjacent solidification of lung may furnish a cavernous inspiratory sound combined with more or less of the vesicular quality. This may be distinguished as vesiculo-cavernous respiration. It is recognized by comparison with the respiratory murmur without the limits of a circumscribed area, the latter corresponding to the site of a cavity. The fact of the existence of the cavity may be further established by associated vocal signs.

Other varieties may be mentioned. A cavernous inspiration is sometimes associated with a bronchial expiration. This happens in some cases when lung, completely or considerably solidified, is in contact with, or in close proximity to, a cavity. The bronchial inspiration is not heard over the cavity, but the more intense bronchial expiratory sound extends beyond the solidified lung, and displaces, or, more properly speaking, drowns, the cavernous expiration over the cavity. In another variety the inspiratory sound is at its beginning either bronchial or broncho-vesicular, and it becomes cavernous before its termination. The probable explanation is that air enters the cavity, not at the beginning of the inspiratory act, but before the conclusion of the act; hence, prior to the development of the cavernous respiration the sound represents adjacent solidification of lung.<sup>6</sup>

As is well known, Laennec gave very little attention to the sounds produced by the expiratory act. A young American physician (James Jackson the younger) was the first to study these sounds, twenty years after the discovery of auscultation.

<sup>6</sup> Under the name metamorphosing respiratory murmur (*meta morphosirendes Athmungs gerausch*) Seitz has described a variety of broncho-cavernous respiration in which, using his terms, the first part of the respiratory sound is rude, and the latter part bronchial in character. Inasmuch as by German writers the cavernous and the bronchial respiration are considered as identical, the latter part of the respiratory sound, in the variety described by him, is probably cavernous.

Jackson ascertained the importance of a prolonged expiration, having something of the bronchial character, as a diagnostic sign in the early stage of pulmonary phthisis. The characters which a prolonged expiration may have are of importance when an inspiratory sound is present, but especially so when an inspiratory sound is either wanting or too weak for its characters to be appreciated.

The significance of a prolonged expiration depends on the characters pertaining to pitch and quality. If the pitch be high and the quality tubular, it denotes solidification of lung as if the respiration were completely either bronchial or broncho-vesicular; in other words, as if associated with either a high-pitched tubular or a vesiculo-tubular inspiration. If the pitch be low and the quality non-tubular or simply blowing, it is either a cavernous sign or it denotes delay and hindrance to the free exit of air in the expiratory act, as in cases of emphysema. The prolonged expiration in emphysema is always low and blowing, not high and tubular, at least without the areas in which a normal broncho-vesicular respiration may be present. A prolonged expiration is not a sign of phthisis (exclusive of cavity), unless the pitch be raised and the quality more or less tubular; or, as stated by Jackson, unless it have something of a bronchial character.

I pass by adventitious sounds, simply remarking that my experience corroborates a statement made by Skoda—namely, the pitch of moist bronchial râles, or coarse and fine bubbling, and of the sub-crepitant râle, denotes either, on the one hand, solidification around the tubes in which the râles are produced, or, on the other hand, absence of solidification. The pitch is more or less raised when these râles occur in connection with pneumonia, phthisis, or other affections involving solidification. The pitch is not raised when they occur in bronchitis, in pulmonary oedema, or in other morbid conditions which do not involve solidification of lung.

#### SIGNS REFERABLE TO THE LOUD VOICE AND SPEECH

The analytical study of transmitted voice-sounds is simpler than that of the respiratory sounds, but not less important with reference to clearness and precision as regards the distinctive

characters of vocal signs. Suppression of vocal resonance, and simple diminution of the normal intensity, are signs which do not call for analysis. It is not so with the remaining signs referable to voice and speech—namely, bronchophony, increased vocal resonance, aegophony and pectoriloquy.

Bronchophony, the sign correlative to bronchial respiration, is characterized by concentration of the transmitted voice, nearness to the ear, and elevation of pitch, as compared with the diffusion, distance, and lowness of pitch, which are the characteristics of the normal vocal resonance. It is important to note that intensity is not an element of bronchophony; the distinctive characters of this sign may be not less marked with a feeble as with a loud vocal resonance.

An abnormal loudness of the transmitted voice-sounds, without the characteristics of bronchophony—that is, the characters of the normal resonance preserved exclusive of intensity—is to be distinguished as increased vocal resonance. This sign signifies either a degree of solidification falling short of that requisite for bronchophony, or the transmission of a voice through a cavity.<sup>7</sup> It seems an incongruity, but clinical experience shows it to be true, that a moderate degree of solidification of lung may give rise to more intensity of resonance than a greater degree of solidification, the lesser resonance having the characters of bronchophony, and the greater resonance retaining the characters of the normal resonance exclusive of intensity. A cavity not surrounded by solidified lung may be represented by notable intensity of vocal resonance, but without the bronchophonic characters.

Normal bronchophony is sometimes found within the area in which the respiration may be normally broncho-vesicular. In general, however, within this area—that is, over the primary and secondary bronchi, the resonance is simply more intense than in the other thoracic regions.

<sup>7</sup> I dissent from the statement made by some writers that bronchophony is a cavernous sign. Clinical study, as I believe, shows that merely intensification of the resonance is the sign when the voice is transmitted through a cavity. The voice may be bronchophonic over a cavity surrounded by solidified lung, but the sign then represents the latter condition, and not the cavity.

The opinion held by Laennec, that pectoriloquy is exclusively a cavernous sign, has long since been disproved. Articulated words, or the speech, in addition to the voice, may be transmitted by solidified lung as well as through a cavity. The characters pertaining to the transmitted voice, associated with the speech, however, enable the auscultator to decide, in individual cases, whether the pectoriloquy be, or be not, a cavernous sign. If pectoriloquy be accompanied by the characters distinctive of bronchophony (nearness to the ear, and elevation of pitch), the transmission is by solidified lung; if on the other hand, speech be transmitted, and the characters of bronchophony be wanting, the inference is that the pectoriloquy denotes a cavity. Two varieties of pectoriloquy, therefore, may be recognized—namely, bronchophonic and cavernous. This statement conflicts with the opinion of Skoda and others, who hold that pectoriloquy is simply an exaggeration of bronchophony.

I would remark that pectoriloquy, which may be defined as the transmission of speech, is often not sharply discriminated by writers on auscultation, as well as by practical auscultators, from bronchophony—the latter being the transmission simply of the voice; and it is evident that the discrimination was not clearly made by Laennec. Laennec seems to have been biased by a desire to establish pectoriloquy as exclusively a cavernous sign. That pectoriloquy is entitled to be considered as a sign distinct from bronchophony, is shown by the fact that it may exist without any of the characters of the latter. Under these circumstances, in accordance with what has been stated, it is always a cavernous sign.

To the vocal sign called aegophony, Laennec, in his treatise on auscultation, devoted more space than to any other physical sign; and perhaps there is no sign which has been more discussed than this by subsequent writers, although it is a sign of comparatively small practical importance, inasmuch as other well-marked and readily available signs suffice for the diagnosis of pleural effusion. Laennec confessed that he encountered much difficulty in the explanation of this sign. That, as a rule, if not invariably, the sign represents pleural effusion, I do not

doubt, notwithstanding the opinion of Skoda and others to the contrary.

Here, as in other instances, Laennec naturally sought to give an idea of the sign by comparisons. The name which he gave to it applies resemblance to the cry of the goat. He also compared it to the voice when a counter is placed between the teeth and the lips, to the voice transmitted through a metallic speaking-trumpet, and to the nasal intonation which is assumed in the performances of Punch. Studied analytically, it has the concentration and the high pitch of bronchophony. It differs from the latter sign in being distant, and its tremulous or bleating character.<sup>8</sup>

#### SIGNS REFERABLE TO THE WHISPERED VOICE

The sounds heard over the thorax when words are whispered, have not, as yet, been recognized as forming a separate group of auscultatory signs. They seem to me to be entitled to this distinction. It is true that a whisper is almost always an expiratory act, and, therefore, the characters of the sounds thus produced are identical with those of expiration in the respiratory signs. The expiratory effort in a whisper, however, as a rule, has more force and emphasis than in the acts of respiration; hence, the characters of the sounds heard over the thorax are more marked; and, moreover, there is sometimes an advantage in listening to these sounds disconnected from the inspiratory

<sup>8</sup> I refrain in this paper from entering into a consideration of the mechanism of signs; but with regard to aegophony I will venture to offer an explanation, which I do not remember to have met with in any work on auscultation. It is that, the sign is produced when, owing to either old adhesions, or recent agglutination by fibrinous exudation, the pleural surfaces adhere in the upper part of the chest, so that the lung resists the pressure of the liquid; consequently, the pressure upon the lung below the adherence condenses it to such a degree as to give rise to bronchophony. The bronchophony, under these circumstances, lacks the nearness to the ear which it has when liquid is not present, and the presence of the liquid causes the goat-like characters of the sound. This explanation tallies with the fact that the sign is generally limited to a narrow strip near the level of the liquid, and also with the fact that the sign is rarely found except when the level of the liquid is at or near the lower angle of the scapula. According to this explanation, as well as to the results of analysis, aegophony is a modification of bronchophony.



sounds. Practically, the whispered voice will be found useful, especially in the diagnosis of incipient pulmonary phthisis.

The whispered voice, as heard over the healthy chest, may be called the normal bronchial whisper, inasmuch as the same is conducted by the bronchial tubes. The normal bronchial whisper is low in pitch, its quality is blowing, and its intensity in different persons variable, these characters corresponding to those of the expiratory sound in the normal respiratory murmur. The characters are normally modified over the primary and secondary bronchi, especially on the right side of the chest, in the same way as the expiratory sound in normal broncho-vesicular respiration. The abnormal modifications may be named so as to correspond with the signs referable to the loud voice, as follows: 1. Increased bronchial whisper; 2. Bronchophonic whisper, or whispering bronchophony; 3. Cavernous whisper; and, 4. Whispering pectoriloquy.

The whispered, as well as the loud voice and the respiration, may be amphoric; but I pass by now, as hitherto, this sign, for the reason that it does not require analytical study, the musical intonation being alone sufficient for its recognition.

The bronchophonic whisper is correlative to bronchophony referable to the loud voice, and to bronchial respiration. It is a high-pitched tubular sound, more or less intense.

Increased bronchial whisper is correlative to increased vocal resonance and to broncho-vesicular respiration. It is less high in pitch, less tubular, and less intense than the bronchophonic whisper.

The cavernous whisper is correlative to cavernous respiration. It is low in pitch, blowing in quality (as distinguished from tubularity), and of variable intensity.

In whispering pectoriloquy the speech—that is, articulated words—are conveyed to the ear of the auscultator. Whispered speech is oftener transmitted than words spoken with the loud voice. The whispered words may be transmitted either by solidified lung or through a cavity, and it is easy to determine, in individual cases, whether or not it be a cavernous sign. If the pectoriloquous whisper be also bronchophonic—that is, the sound

high in pitch and tubular in quality—the conduction is by solidified lung. If, on the other hand, the whispered words be associated with the characters of the cavernous whisper, the conduction is through a cavity.

#### SIGNS PRODUCED BY PERCUSSION

The advantages of the analytical method of study are as marked in its application to percussion as to auscultation. The results of the study, however, will require much less extended consideration.

Taking, as a point of departure, percussion in health, and the characters of the normal resonance as a standard for comparison, the number of morbid signs need not exceed six, and considering, as might be done, three of these as varieties of one sign, the number is reduced to four. Thus, either four or six signs represent the important morbid physical conditions incident to different pulmonary diseases, in so far as these conditions are determinable by percussion. An important result of the analytical method of study is the elimination of such vague terms as full, empty, hard, wooden, tracheal, bandbox resonance, &c.

The normal resonance on percussion varies in different persons and in different parts of the chest, as regards intensity. As compared with all the morbid signs produced by percussion, it is always low in pitch. The quality is *sui generis*, and being due to the air vesicles, it may properly be called vesicular.

One of the signs is characterized by absence of all resonance or flatness. Of course this sign has no characters pertaining to pitch or quality of sound.

Diminished resonance or dullness is another sign. In this sign the vesicular quality of sound is decreased in proportion to the diminution of resonance or the degree of dullness, but more or less of the quality is appreciable. The pitch is always higher than that of the normal resonance of the person examined. The elevation of pitch is of practical value in determining a slight degree of dullness.

A third sign is tympanitic resonance. Intensity should not

be considered as an element in the characters distinctive of this sign. A tympanitic resonance may be either more or less intense than the normal resonance of the person examined. The chief characteristic of the sign relates to the quality of sound; the resonance is devoid of vesicular quality. A resonance absolutely non-vesicular is always tympanitic. Tympanitic resonance and non-vesicular resonance are, therefore, convertible terms. The pitch is always higher than a resonance with vesicular quality.

The fourth sign is a resonance in which the vesicular is combined with the tympanitic quality, and the intensity of the resonance abnormally increased. I have proposed to distinguish this sign by the descriptive name, vesiculo-tympanitic resonance. The pitch is always higher than that of the normal resonance of the person examined. This vesiculo-tympanitic resonance is a diagnostic sign in cases of vesicular emphysema. It is the resonance found above the level of the liquid in cases of pleuritic effusion, and over the healthy lobe of a lung when another lobe of the same lung is the seat of lobar pneumonia.

In order to illustrate the characters of this sign, and also its practical value, I will state a problem in diagnosis:—

Let it be supposed that a patient having had cough and expectoration for a considerable period, together with deficiency of breath on exercise, is a subject for a physical examination of the chest. Over the upper anterior thoracic regions, on the right side, the resonance on percussion is found to be notably less in degree than over the corresponding regions on the left side. The difference, as regards intensity of resonance, between the two sides in these regions, is distinctly greater than the normal disparity. Now, if the relatively less intense resonance on the right side be considered dulness, this sign, in connection with the symptoms, points to the existence of pulmonary phthisis. But the relatively less intense resonance on the right side may not be dulness—it may be due to an abnormal increase of the resonance of the left side. If this be so, the greater resonance on the left side points to vesicular emphysema. The question whether the difference in the intensity of resonance between the

two sides be due to an increase of the resonance on the left side (denoting emphysema), or to dulness on the right side (denoting phthisis), is to be settled by comparing the resonance on the two sides as regards characters other than intensity—that is, by the characters relating to pitch and quality. If the resonance in the hypothetical case which has been stated, be higher in pitch, as well as more intense on the left side than the resonance on the right side, it is a vesiculo-tympanitic resonance, and denotes emphysema. If, on the other hand, the resonance on the right side be higher in pitch than that on the left side, as well as less intense, it is dulness, and denotes a certain degree of solidification of lung.

The error of confounding phthisis and emphysema is not infrequent: two diseases differing widely in respect of gravity, and the latter protective in a great measure against the former. Assuming, in a case offering the problem just stated, the disease to be pulmonary emphysema, the relatively lesser resonance on the right side of the chest is, in fact, an increased or a vesiculo-tympanitic resonance, as may be shown by comparing the resonance on this side in the regions named with that of the resonance over the lower lobe of the lung on the same side. This is in accordance with the rule that vesicular emphysema, when not lobular or vicarious, is bilateral, affecting the upper more than the lower lobes on the two sides, and generally the upper lobe of the left more than the upper lobe of the right lung.

Amphoric and cracked-metal resonance on percussion may be considered as varieties of tympanitic resonance. They are covered by the definition of tympanitic resonance, that is, the resonance is non-vesicular. They are readily enough distinguished by their characteristics. Perhaps, in view of their significance as cavernous signs, it is more convenient to enumerate them as distinct signs.

I have endeavoured in this short paper to give an exposition of the method of study which, as it seems to me, secures for auscultation and percussion simplicity, together with completeness and precision in their application to physical diagnosis, and I have submitted results to which I have been led by pur-

suings this study as a branch of clinical medicine. If the tone of my paper may have appeared to show undue assurance—or even dogmatism, I would plead in extenuation that in order not to presume too much on the patience of my hearers and readers, I have sought to condense the matter as much as possible. As a further plea, I may add that I have, for many years been a student and teacher of auscultation and percussion, and that I have reached the age when some indulgence may be claimed on the score of no longer remaining among the junior members of our profession.

THE END.

# MEDICAL CLASSICS

*Compiled by*

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OF THE DEPARTMENT OF SURGERY, ALBANY MEDICAL COLLEGE

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## Friedrich Trendelenburg

### BIOGRAPHY

- 1844 Born May 24 in Berlin, son of a Professor of Philosophy in the University of Berlin. Early education received at home, learning English from his mother, Latin and arithmetic from his father, grammar from his aunt. Later attended a boy's school in Berlin.
- 1862 Age 18. Went to Scotland with his family for a year rather than attend a boarding school in Berlin.
- 1863 Age 19. Studied anatomy, embryology and physics in Glasgow. Later in year entered University of Berlin.
- 1864 Age 20. Took preliminary medical examinations and studied in clinics of Traube, Jungen and von Langenbeck.
- 1865 Age 21. Traveled with study in Jena, Halle and Heidelberg.
- 1866 Age 22. Received degree in medicine from the University of Berlin and was made military surgeon in hospital in Gorlitz.
- 1867 Age 23. Took state examinations and wrote his thesis on Ancient Indian Surgery (*De veterum Indorum chirurgia*). Military surgeon at Kiel.
- 1868 Age 24. Assistant to von Langenbeck until 1874.
1872. Age 28. Founded German Society of Surgeons.
1874. Age 30. Director of surgical ward, Friedrichschain Hospital, Berlin, until 1875. Married Charlotte Fabricus and had 6 children.
- 1875 Age 31. Ordinarius of surgery, University of Rostock, until 1882.

- 1882 Age 38. Ordinarius of surgery, University of Bonn, until 1895.
- 1890 Age 46. First described Trendelenburg position although report had been written by his pupil, Dr. Willy Meyer, in 1885. Also described operation for varicose veins.
- 1895 Age 51. Ordinarius of surgery, University of Leipzig, until 1911.
- 1898 Age 54. Chairman, German Society of Surgeons.
- 1923 Age 79. Historian, German Society of Surgeons.
1924. Age 80. Died December 16, in retirement at Nikolasee.

## EPONYMS

**CANNULA**—a cannula covered with a dilatable rubber bag; used for closing the trachea to prevent the entrance of blood after tracheotomy.

**OPERATION**—A. Excision of varicose veins.

B. Ligation of great saphenous vein to prevent reflux into varicose veins. First description concerned division of long saphenous at point of junction of lower with middle third of thigh. In a subsequent modification two more ligatures were placed on the saphenous: one above the level of the internal condyle and the other below the knee. (Keen)

C. Removal of a pulmonary embolus.

D. For a slipping patella; the external condyle is raised and an ivory peg is inserted.

**POSITION**—The head-down position, the patient on the back on a plane inclined  $45^{\circ}$ , the legs and feet hanging over the end of the table, causing the intra-abdominal organs to move away from the pelvis toward the diaphragm.

**SIGN**—of congenital dislocation of the hip; when the patient stands on his normal leg and raises the other leg off the ground, the gluteal fold on this side rises slightly with the limb in a normal manner; when he stands on the affected leg, the gluteal fold on the sound side falls instead of rising.

**SYMPTOM**—A waddling gait due to paralysis of the gluteal muscles.

**TEST**—for insufficiency of the valves in varicose veins. When the patient lies down and the involved leg is elevated, the

distended saphenous vein will collapse as the blood drains into the trunk. If then the patient stands while a finger is held firmly at the junction of the saphenous and femoral, the vein will continue to empty until the finger is removed, when it will quickly fill up by a reflux of blood from above downward and not, as in normal conditions, from below upward.

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## INTRODUCTION

Every surgeon today is likely to ask for "the Trendelenburg position" when he is operating in the abdominal cavity. If he considers for a moment he will probably ask for the "elevated pelvic position" but the name Trendelenburg has become so firmly attached to this posture and is so commonly used that he readily employs the eponym.

Friedrich Trendelenburg received a very good education in medicine at the University of Berlin and later studied under Traube, Jungen, and von Langenbeck and at the clinics in Jena, Halle, and Heidelberg. In 1866 at the age of twenty-two he was appointed military surgeon in a hospital at Gorlitz. Two years later he became an assistant to von Langenbeck, beginning an association which lasted for six years. At the age of thirty-one he became Ordinarius in Surgery at the University of Rostock and seven years later transferred in the same position to the University of Bonn.

In Trendelenburg's time the field of abdominal surgery was being extended rapidly. In 1849 gastrotomy was introduced by Sédillot and in 1858 the first English case was reported by Forster. In 1864 the first successful ovariectomy in France was reported by Jules Péan. In 1878 Freund had used an elevated posture to facilitate operations in the pelvis. In 1881 Billroth had described his operation on the stomach. Also in 1881 Czerny removed subperitoneal fibroids per vaginum.

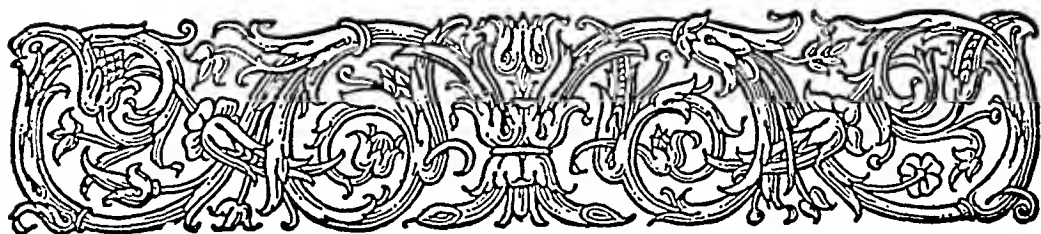
During his early professional life Trendelenburg was attempting to improve operations on the bladder, especially for vesico-vaginal fistula. He used the elevated pelvic position which caused the intra-abdominal organs to settle toward the diaphragm and away from the pelvis and bladder. The first report of this position was made by the late Dr. Willy Meyer of New York City who was then a student of Trendelenburg's. This first report, with the permission of his "venerable chief," was published by Meyer as *Ueber die Nachbehandlung des hohen Steinschnittes sowie über Verwendbarkeit desselben zur Operation von Blasenscheidenfisteln*, (*After-treatment in suprapubic cystotomy and its application to the operation for vesico-vaginal fistula*), in *Archiv für klinische Chirurgie*, 31: 494-525, 1885. The first description of the position which was written by Trendelenburg is herein reproduced, *Ueber Blasenscheidenfistel operationen und ueber Beckenhochlagerung bei Operationen in der Bauchhöhle*, (*Operations for vesico-vaginal fistula and the elevated pelvic position for operations within the abdominal cavity*), published in *Sammlung Klinischer Vorträge* (Volkmanns), 355 (Chir., 109): 3373-3392, 1890. The position was used by Trendelenburg in an attempt to introduce air into the open bladder, following the "principle of

Sim's posture (1845) where the vulva is the most elevated point of the body and the open vagina admits the air because of negative intrapelvic pressure and thus becomes distended."

The Trendelenburg position is used today not only to facilitate operating in the abdominal cavity but as a post-operative posture to decrease pulmonary complications. Dr. Howard E. Gray of the Mayo Clinic reported in 1934 very favorable results by using this position for the first twenty-four hours following abdominal operations.

In the same year in which Trendelenburg's paper on the elevated pelvic position appeared he published a work, *Ueber die Unterbindung der Vena saphena magna bei Unterschenkelvaricen*, (*Ligation of the great saphenous vein for varicose veins of the leg*), in *Beiträge zur klinischen Chirurgie*, 7: 195-210, 1890. This paper is here published in its entirety. The operation which Trendelenburg devised is performed frequently today but even more important are the diagnostic signs which he described as indications for surgical treatment of varicose veins. Today with modern injection therapy these signs and tests of Trendelenburg's are still universally employed. Thus we see the value of reproducing this paper in MEDICAL CLASSICS.

The papers herein reproduced are given in the original German and the English translation which follows each one was made by Dr. William de Rouville of Albany, N. Y.



# Über Blasenscheidenfisteloperationen und über Beckenhochlagerung bei Operationen in der Bauchhöhle

VON  
FRIEDRICH TRENDELENBURG

*in Bonn*

*Mit einer Lichtdrucktafel*

Sammlung Klinischer Vorträge (Volkmanns), Leipzig, 355 (Chir., 109): 3373-3392, 1890

## POSITION

**S**EIT ihrer Begründung durch Naegele, Dieffenbach und Jobert de Lamballe ist die Operation der Blasenscheidenfistel, besonders durch das operative Talent und die unermüdliche Ausdauer von Gustav Simon, zu einem so hohen Grad von Vollkommenheit gebracht worden, dass dieses Kapitel der gynäkologischen Chirurgie auf den ersten Blick fast vollständig abgeschlossen zu sein scheint. Neuere Vorschläge beziehen sich auf Modifikationen der Instrumente, der Lagerung und des Nahtmaterials, der Vorbereitung zur Operation und der Nachbehandlung; das Princip der Operation bleibt immer dasselbe: Freilegung und Anfrischung der Fistel von der Scheide aus, Nahtverschluss durch direkte Vereinigung der Ränder in verschiedenen, der Form und Grösse des Defektes angepassten Figuren. Geschickten und geübten Händen gelingt

es in der grossen Mehrzahl der Fälle, mit dieser Methode zum Ziele zu kommen, und für alle gewöhnlichen Fälle von Blasenscheidenfistel wäre es eine überflüssige Künstelci, das einfache Verfahren durch complicirtere zu ersetzen.

Neben der Mehrzahl günstiger Fälle giebt es aber eine Minderzahl ungünstiger, in denen dieses Verfahren mit sehr erheblichen Schwierigkeiten zu kämpfen hat und nicht selten trotz wiederholter Operationsversuche vollständig im Stiche lässt. Winckel<sup>1</sup> berechnet, dass über ein Zehntel aller Frauen mit Harnfisteln ungeheilt bleibt.

Zu den ungünstigen Fällen von Harnfisteln gehören zunächst die Blasenscheidengebärmutterfisteln und die Harnleiterscheidenfisteln, sodann (S. 3374) vor Allem die Blasengebärmutterfisteln, welche mit der Methode der direkten Vereinigung von der Scheide aus garnicht anzugreifen sind.

Aber auch bei den eigentlichen Blasenscheidenfisteln können mancherlei Schwierigkeiten dem Gelingen der Operation hindernd in den Weg treten. Narbige Stenosen der Scheide erschweren den Zugang zur Fistel, Verwachsungen mit dem Becken machen es unmöglich, den Uterus und die Blasenscheidenwand herabzuziehen, die Nähe des Ureters verbietet eine genügend ergiebige Anfrischung des Fistelrandes, oder die Grösse des Defektes und die ungünstige Lage desselben dicht an der Urethra lässt eine Vereinigung der Ränder nicht ohne störende Spannung zu Stande kommen. Die Schwierigkeiten können unter Umständen so gross sein, dass die Fistel sich durch die Operation wohl verkleinern, aber nicht vollständig zum Verschluss bringen lässt.

Eine unvollständige Heilung aber verbessert den Zustand der Frau gewöhnlich garnicht; nach wie vor träufelt der Urin durch die Scheide ab; als letztes Hilfsmittel bleibt nur die Kolpokleisis übrig, welche das Ubel beseitigt, indem sie eine andere Infirmität an seine Stelle setzt,—ein testimonium paupertatis der plastischen Chirurgie.

Bei der heutigen Vertheilung des operativen gynäkologischen

<sup>1</sup> Winckel, Die Krankheiten d. weibl. Harnröhre u. Blase. Deutsche Chir. 62. 1885.



Materials gehen der chirurgischen Klinik verhältnismässig wenige und wohl mit Vorliebe ungünstige Fälle zu, ich kann mich daher keiner sehr breiten Erfahrung in Blasenscheidenfisteloperationen rühmen, andererseits habe ich einige Male Veranlassung gehabt, mich mit lebhaftem Interesse mit dem Problem zu befassen, für besonders ungünstige Fälle andere Wege des Verschlusses ausfindig zu machen, als die gewöhnlich betretenen.

Nach zwei Seiten haben meine Versuche zu brauchbaren Resultaten geführt. Es hat sich gezeigt:

- 1) dass Fisteln, welche von der Scheide aus nicht genügend zugänglich zu machen sind, mit Erfolg von der Blase aus freigelegt, angefrischt und vernäht werden können, und
- 2) dass Fisteln, welche sich durch direkte Vereinigung der Ränder nicht schliessen lassen, unter Umständen durch Deckung mit einem Lappen aus der hinteren Scheidenwand geschlossen werden können.

#### 1.

Die Operation einer Blasenscheidenfistel von der Blase aus würde einem Jobert und Dieffenbach, wahrscheinlich auch noch G. Simon als ein abenteuerliches Unternehmen erschienen sein; wer die Fortschritte der Blasen Chirurgie in den letzten 10–15 Jahren verfolgt hat, wird sich mit dem Gedanken leicht befreunden. In dieser Zeit hat der früher gefürchtete hohe Steinschnitt in verbesserter Form sich mehr und mehr als (S. 3375) ein fast ungefährlicher Eingriff erwiesen, wir haben uns davon überzeugt, dass sich auch grosse Wunden der Blasenwand mit Leichtigkeit durch Naht zur Heilung bringen lassen, und die Beckenhochlagerung hat uns ein Mittel an die Hand gegeben, im Inneren der Blase unter Leitung des Auges ebenso bequem oder bequemer zu operiren wie in der Scheide. Nichts liegt also näher, als bei Fisteln, welche von der Scheide aus nicht mit Erfolg anzugreifen sind, einen Angriff von der Blase her zu unternehmen.

Meine ersten, allerdings erfolglosen Versuche in dieser Richtung (1881 u. 1884)<sup>2</sup> sind ziemlich unbeachtet geblieben. Nur König

<sup>2</sup> Willy Meyer, Über die Nachbehandlung des hohen Steinschnitts, sowie über Verwendbarkeit desselben zur Operation von Blasenscheidenfisteln. Arch. f. klin. Chir. 1885. Bd. XXXI. p. 521.

hat sie wiederholt.<sup>3</sup> Es hängt dies damit zusammen, dass auch die "Beckenhochlagerung", welche allein das Innere der Blase so aufzuschliessen vermag, dass man feinere Operationen in der Blase vornehmen kann, längere Zeit nicht die Beachtung gefunden hat, die sie meiner Überzeugung nach verdient.

Ich möchte daher das Wesen und die Vortheile dieses Verfahrens in kurzen Worten nochmals hervorheben.

Lagert man den Körper eines Kranken auf dem Operationstisch so, dass die Symphysis pubis der höchste Punkt des Rumpfes ist und die Axe des Rumpfes mit der Horizontalen einen Winkel von wenigstens 45° bildet, so sinken sämtliche Eingeweide, vor Allem Leber, Milz und Mesenterium, durch ihre Schwere in die Höhlung des Zwerchfells hinunter. Der Darm folgt und fällt aus dem kleinen Becken heraus, so weit der Luftdruck dieses zulässt. Bei mageren Individuen und erschlafften Rekti in tiefer Narkose wird die vordere Bauchwand in der Regio hypogastrica von der Beckenhöhle her förmlich angesaugt, so dass sich in dieser Gegend eine tiefe Grube bildet.

Macht man nun in der Regio hypogastrica zum Zweck des Steinschnitts einen Längs- oder Querschnitt und spaltet die Rekti sowie die hinter ihnen liegende Fascie, so tritt sofort Luft in den prävesicalen Raum ein, oft mit hörbarem Geräusch, die Peritonealfalte fällt herunter, und aus dem prävesicalen Spalt-raum wird ein weitklaffender Hohlraum, in den das Licht frei hineinscheint und in dem das Auge die vordere Wand der Blase und die Umschlagsfalte des Peritoneum sehen kann. Man lässt zwei Finger der linken Hand in die Wunde gleiten, um das Peritoneum zu schützen und kann nun die vordere Blasenwand unterhalb der Peritonealfalte mit der grössten Sicherheit incidiren, ohne dass die Blase mit Flüssigkeit ausgedehnt und ohne dass die mittelst des Mastdarmcolpeurynters von Petersen in die Höhe gehoben zu sein braucht. (S. 3376) Letzteres Hilfsmittel wende ich niemals mehr an; eine mässige Füllung der Blase mit Flüssigkeit dagegen ist von einigem Vortheil.

Wie leicht und sicher der hohe Steinschnitt sich in dieser Weise ausführen lässt, erhellt am besten aus der Kürze der erforder-

<sup>3</sup> Verhandlungen der Deutschen Gesellsch. f. Chirurgie. XVII. 1888. p. 100.

lichen Zeit. Bei den letzten Steinschnitten zählten meine Herren Assistenten 35 und 50 Sekunden vom ersten Hautschnitt bis zur vollendeten Extraktion des Steines.

Ebenso überraschend ist der Nutzen der Beckenhochlagerung bei intraperitonealen Operationen in der Beckenhöhle und den unteren Abschnitten des Bauches.

Es handelt sich z. B. um eine Darmresektion, durch welche ein widernatürlicher After am Schenkelring (nach Brucheingklemmung) beseitigt werden soll. Die Patientin wird in Beckenhochlage gebracht. Dicht oberhalb der Fistel (die Patientin stehend gedacht) wird ein etwa 10 cm langer bogenförmiger Schnitt parallel dem Poupart'schen Bande durch die Bauchdecken gemacht, das Peritoneum wird incidirt, Luft dringt in die Peritonealhöhle ein, sämtliche Darmschlingen rutschen nach dem Zwerchfell zu hinab. Die Wundränder werden mit Haken auseinander gezogen, und wir sehen nun in das leer gewordene kleine Becken hinein, wir übersehen die ganze Fossa iliaca, und der einzige Darmtheil, der sich präsentirt, ist die an den Schenkelring angelöthete Schlinge. Wir können das Verhalten ihrer beiden Schenkel zu einander mit dem Auge kontrolliren, können sie bequem mit dem Finger anhängen, hervorziehen, durchschneiden und vernähen, kein Inhalt fließt aus, da, was von flüssigem Inhalt etwa noch da war, nach dem Zwerchfell zu abgeflossen ist. Wir arbeiten dabei im vollen Licht des gegenüberliegenden Fensters, wie der Maler an seiner Staffelei, ohne genöthigt zu sein, uns zu bücken und, falls die Narkose ruhig ist, ohne durch heraustretende Darmschlingen belästigt zu werden.

In gleicher Weise machen sich die Vortheile der Beckenhochlagerung bei allen gynäkologischen Operationen in der Beckenhöhle geltend, und ich glaube, wer einmal einen Uterus mit Myomen oder eine verwachsene Ovarialcyste in dieser Weise exstirpirt hat, wird sich nicht leicht dazu entschliessen zu dem alten Verfahren zurückzukehren. Soweit ihre Verbindungen im kleinen Becken es gestatten, fällt die Geschwulst aus der Beckenhöhle heraus dem Operateur entgegen, alle zu trennenden Verbindungen spannen sich an, das Blut fließt von dem Operationsfeld ab, um die Därme braucht man sich, so lange kein

Erbrechen erfolgt, garnicht zu kümmern, sie bleiben bescheiden in der Magenrube liegen, vor Allem: man sieht, was man macht.

Ist der Tumor entfernt, so ist man überrascht durch den freien Einblick in die ganze Höhle des kleinen und grossen Beckens, man sieht die Iliaca, die Hypogastrica pulsiren, sieht den Ureter darüber (S. 3377) hinwegziehen, sieht ringsum die noch blutenden kleinen Gefässe und kann sie mit der grössten Leichtigkeit umstechen oder unterbinden. Nach der Entfernung der Ovarialcyste liegt hier der unterbundene Stiel, hier der Uterus und dort das gesunde Ovarium und seine Tube, vorher liess sich der gedrehte Stiel ad oculos demonstrieren.

Einen grossen Gewinn bringt die Beckenhochlagerung der Myomotomie, besonders in schwierigen Fällen mit interligamentärer Ausbreitung der Geschwülste.

Die Operation lässt sich mit Leichtigkeit so modificiren, dass man statt der supravaginalen Amputation die Totalexstirpation des Uterus ausführt.<sup>4</sup> Man dringt mit der Auslösung der Geschwülste, durch Darmschlingen unbehelligt, immer nur da doppelt unterbindend, umstechend, schneidend, wo man sieht, bis zum Cervix vor, schiebt die Blase nach querer Incision der Peritonealfalte vom Uterus ab, und legt so das Vaginalgewölbe frei. Die Vagina war vorher gründlich desinficirt worden und mit Jodoformgaze ausgestopft. Gegen den Jodoformgazeballen schneidet man nun die Vaginalwand ringsum quer durch, entfernt die ganze Geschwulstmasse sammt Uterus und Portio, und umsticht und unterbindet die blutenden Gefässe der Vaginalwand. Sodann wird die Jodoformgaze von der Vulva her aus der Vagina herausgezogen und die Scheide von der Bauchhöhle aus von Neuem mit Jodoformgaze lose angefüllt, einige Streifen der Gaze reichen nach hinten und seitlich bis in die Taschen unter dem Bauchfell, in denen die ligamentären Geschwülste eingebettet

<sup>4</sup> Schon Hofmeier fand es in einem Fall von Uterusmyom, welches sich von der hinteren Fläche des Cervix aus entwickelt hatte, und zwischen Scheide und Bauchfell in die Tiefe des kleinen Beckens hineinragte, sehr schwierig, unter der Geschwulst her an den Cervix zu gelangen, und liess die Abtragung daher schliesslich nicht im Cervix, sondern in den oberen Theilen der Scheide erfolgen. Später hat Schröder noch einmal bei einem kolossalen Tumor in derselben Weise mit gutem Erfolg operirt. Vergl. M. Hofmeier, Grundriss der gynäkologischen Operationen. p. 222.

waren. Genäht wird in der Bauchhöhle nicht. (4 Operationsfälle.)

Dieses Verfahren zeichnet sich vor der gebräuchlichen supravaginalen Amputation des Uterus durch Sicherheit und Einfachheit aus. Alle Akte der Operation lassen sich bei Benutzung der Beckenhochlagerung unter Kontrolle des Auges ausführen, der Blutverlust ist gering und die elastische Umschnürung des Uterus dabei überflüssig, auch die zeitraubende Vernähung des Uterusstumpfes fällt weg. Antiseptischer Verschluss und Drainage der Bauchhöhle durch Zustopfen der Öffnung im Peritoneum erweisen sich als ebenso zweckmässig, wie bei der vaginalen Totalexstirpation des Uterus wegen Carcinoms und wie bei der hohen Exstirpation des Rektum bei Rektumcarcinomen. Man hüte sich dabei nur, viel Jodoform in die Bauchhöhle selbst einzubringen.

Vielleicht liesse sich das Verfahren der Totalexstirpation des Uterus (S. 3378) bei Myomen durch Benutzung der Berthelot-Péan'schen Zangen, nach Umschneidung der Portio von der Scheide aus, noch weiter vervollkommen.

Voraussichtlich wird sich die Beckenhochlagerung mit Vorthail auch bei einer Operation verwenden lassen, welche ich vor einigen Jahren bei einer Hydronephrose vornahm und welche den Zweck hat, die Ursache der Hydronephrosenbildung, die abnorm hohe und klappenförmige Insertion des Ureters am Nierenbecken zu beseitigen.

Durch einen Längsschnitt am äusseren Rande des Rektus wird die Bauchhöhle geöffnet und die vordere Wand der grossen hydronephrotischen Geschwulst freigelegt. Man findet am medianwärts gelegenen Theil der vorderen Wand leicht den Ureter auf, der, wie schon Simon festgestellt hat, durch eine Drehung des sich ausdehnenden Nierenbeckens um seine Axe immer nach vorn hervorgehoben ist. Etwa handbreit von dem Ureter entfernt wird die Cyste mit dem Troicart punktiert und möglichst entleert. Darauf wird die vordere Wand von derselben Stelle aus nach unten zu frei gespalten und im Innern der so geöffneten Cyste die Mündungsstelle des Ureters aufgesucht. Sodann wird von der Mündungsstelle aus der Ureter und die

Cystenwand mit der Scheere nach unten zu in der ganzen Ausdehnung der Geschwulst aufgeschlitzt und die Wundränder des aufgeschlitzten Ureters werden mit den Wundrändern der Cystenwand dicht vernäht. Die Öffnung ist so in den untersten Abschnitt der Geschwulst verlegt. Endlich wird die Cyste nach hinten, nach der Lumbalgegend zu, drainirt, der erste Eröffnungsschnitt wieder zugenäht und die Bauchwunde geschlossen.

Der Fall, in dem ich die Operation ausführte, verlief tödtlich durch Ileus in Folge einer Knickung des mit dem Sack festverwachsenen Colon ascendens. Zu weiteren Versuchen fehlte mir die Gelegenheit.

Sehr gute Dienste leistete mir die Beckenhochlagerung auch bei der Aufsuchung einer Stichverletzung des Darmes und ebenso bei der Aufsuchung und Resektion einer tuberkulösen Strikture des Dünndarms. In beiden Fällen war von vornherein mit Sicherheit anzunehmen, dass die betreffende Darmschlinge in dem unteren Abschnitt der Bauchhöhle gelegen sei.

Bei Laparotomien wegen innerer Incarceration ist die Beckenhochlagerung des hohen positiven Druckes in der Bauchhöhle wegen von geringem Nutzen.

Dagegen ist sie ein ausgezeichnetes Mittel, um das Innere der Vagina oder des Rektum dem Auge zugänglich zu machen. Beide Höhlen aspiriren Luft und klaffen weit, sobald der Eingang in dieselben mit den Fingern, einem kurzen Speculum oder dergleichen offen gehalten wird. Besonders das Innere des Rektum kann man sich durch kein anderes Hilfsmittel in so ergiebiger Weise freilegen.

(S. 3379) Dass der Druck in dem unteren Abschnitt der Bauchhöhle bei der Hochlagerung des Beckens ein negativer wird, lässt sich an einem Manometer leicht demonstrieren. Man braucht dasselbe nur durch einen Gummischlauch mit einem Katheter in Verbindung zu setzen, welcher in die Blase eingeführt ist. Bei horizontaler Lage des Körpers ergab sich bei einigen Versuchen ein Druck von  $+1$  cm, bei Beckenhochlagerung ein Druck von  $-6$  bis  $8$  bis  $-11$  cm Wasser.

In historischer Beziehung ist zu bemerken, dass die Beckenhochlagerung schon von den alten Chirurgen bei der Taxis

eingeklemmter Brüche angewandt wurde, die eingeklemmte Darmschlinge sollte durch die Schwere des Mesenterium aus der Bruchpforte herausgezogen werden, durch kräftiges Schütteln des Körpers suchte man das Herausgleiten zu befördern. So empfahl Fabricius ab Aquapendente, den Kranken an Händen und Füßen aufzuhängen, den Kopf hintenüber und das Becken höher als den Thorax, und den Schwebenden tüchtig zu schütteln. Corvillard liess den Kranken an den Beinen aufhängen. Nach Sharp soll ein Gehilfe den Kranken auf den Rücken nehmen, die Unterschenkel über die Schultern ziehen, so dass die Kniekehlen des Kranken gerade auf den Schultern des Trägers ruhen. Auch dabei wurde geschüttelt. Ähnlich verfuhr Ribes.<sup>5</sup> Freund<sup>6</sup> lagerte seine Patientin bei der Exstirpation des carcinomatösen Uterus (1878) "auf einen Tisch so, dass ihr Kopf gegen das Fenster gerichtet tiefer als das Becken lag.—Nachdem der Bauch mittelst eines drei Querfinger unterhalb des Nabels beginnenden, bis hart an die Symphyse reichenden Schnittes in der linea alba eröffnet, wurden die im Becken liegenden Darmschlingen herausgehoben und mittelst eines in den Grund der Douglas'schen Tasche eingebrachten und in die Höhe geschlagenen feuchten Handtuches vom Beckenraum entfernt gehalten. Dies gelang bei der oben beschriebenen Lagerung der Frau bis zu Ende der Operation vortrefflich." Dies ist Alles, was von Freund über die Lagerung bei seiner Uterusexstirpation gesagt wird. Augenscheinlich entsprach die Lagerung der Patientin nur in sehr unvollständiger Weise dem, was ich als Beckenhochlagerung bezeichne. Denn bei so starker Erhebung des Beckens, wie ich sie anwende, wäre es bei der "abgemagerten" Frau gewiss nicht nöthig gewesen, die im Becken liegenden Darmschlingen herauszuheben und zurückzuhalten, sie wären mit dem Eintritt der Luft von selbst nach dem Zwerchfell heruntergefallen und kaum zu Gesicht gekommen. Die Operation fand in einem "kleinen neben der Küche befindlichen Proletarierzimmer" statt, der "Tisch" war also wohl kein Operationstisch, sondern ein gewöhn-

<sup>5</sup> Bardeleben, Lehrbuch d. Chirurgie. 8. Aufl. III. p. 792.

<sup>6</sup> Freund, Eine neue Methode der Exstirpation des Uterus. Sammlung klin. Vortr. v. Volkmann Nr. 133. p. 5.

licher Küchentisch, auf dem sich eine wirkliche (S. 3380) Beckenhochlagerung ohne ganz besondere von Freund nicht erwähnte Hilfsvorrichtungen gar nicht herstellen lässt. Dass Freund die Idee der Beckenhochlagerung später in irgend einer Form weiter ausgebildet oder auch nur deutlich ausgesprochen hätte, ist mir nicht bekannt.—Auch in den Lehrbüchern wird bei Besprechung der Freund'schen Operation von der Beckenhochlagerung nichts gesagt.

Ich selbst habe die Beckenhochlagerung zunächst nur bei Operationen an der Blase zu dem Zweck angewandt, um nach der Eröffnung der Blase durch hohen Steinschnitt das Innere der Blase dem Tageslicht und dem Auge zugänglich zu machen (1880). Mit der Freund'schen Mittheilung hatte die Sache nichts zu thun, es schwebte mir vielmehr das Princip der Seitenbauchlage von Sims (1845) vor, bei der bekanntlich die Vulva den höchsten Punkt des Rumpfes bildet und die geöffnete Vagina in Folge des negativen Druckes im Becken Luft aspirirt und dadurch zum Klaffen gebracht wird. In gleicher Weise wollte ich die geöffnete Blase sich mit Luft füllen lassen.<sup>7</sup> Erst später wurden mir die grossen Vorthelle der Lagerung für die Operation des hohen Steinschnittes selbst klar,<sup>8</sup> und dieselbe auch bei Laparotomien anzuwenden war ein weiterer sehr natürlicher Schritt. Seit 1884 operire ich bei jedem hohen Steinschnitt, seit Winter 1887/8 bei allen Laparotomien, wo es sich um Operationen in der Beckenhöhle handelt, von Anfang an nur in Beckenhochlagerung, und es ist kein Semester vergangen, wo ich meinen Zuhörern nicht die eine oder andere Operation der Art demonstirt hätte.

De Léon<sup>9</sup> benutzte die Lagerung bei der Kastration bei Frauen und empfahl sie auch zur gynäkologischen Untersuchung, zur Erleichterung der Palpation der Beckenorgane durch die vordere Bauchwand, besonders bei Tympanie des Bauches. Lange<sup>10</sup> empfahl sie für Laparotomien überhaupt und insbesondere für

<sup>7</sup> Vergl. bei W. Meyer l. c.

<sup>8</sup> Vergl. bei K. Eigenbrodt, Über den hohen Steinschnitt. Deutsche Ztschr. f. Chir. 1888. XXVIII. p. 72.

<sup>9</sup> de Léon. Centralbl. f. Gynäkol. 1888. Nr. 21.

<sup>10</sup> F. Lange. New-Yorker med. Monatsschr. 1889. I. 1. p. 1.



die Uterusexstirpation. In Deutschland hat sich J. Veit<sup>11</sup> ihm angeschlossen und die Vortheile des Verfahrens ausführlicher besprochen. Vor den letztgenannten Veröffentlichungen hat, soweit mir bekannt, von Gynäkologen nur Werth die Beckenhochlagerung angewandt; Mittheilungen darüber stehen zu erwarten.

Über die Technik der Beckenhochlagerung ist nicht viel zu sagen. In den ersten Jahren liess ich einen am Kopfende des Operationstisches stehenden Wärter die Knie des Patienten rücklings auf die Schultern nehmen, wie es die Alten mit ihren Bruchkranken machten: seit längerer Zeit benutze ich einen von Eschbaum konstruirten besonderen (S. 3381) Apparat, der an dem Kopfende des Operationstisches angebracht wird. Eschbaum hatte ihn auf der Kölner Naturforscherversammlung (1888) ausgestellt.—Man beginne die Operation erst, wenn die Narkose vollständig geworden ist und alles Pressen und forcirte Athmen aufgehört hat. Auch während der Operation ist darauf zu achten, dass die Narkose eine vollständige bleibt, durch die tiefe Lage des Kopfes wird sie gewöhnlich in keiner Weise ungünstig beeinflusst. Je magerer das Individuum ist und je leerer der Darm, um so mehr kommen die Vortheile der Lagerung zur Geltung.

Doch nun zurück zum Steinschnitt und zur Operation der Blasenscheidenfistel!

Eröffnet man die Blase bei hochgelagertem Becken durch einen 4–5 em langen Querschnitt parallel der Umschlagsfalte des Peritoneum und lässt die Schnittränder durch stumpfe Wundhaken oder Blasenspecula, wie ich sie mir zu dem Zweck aus weichem Kupfer anfertigen liess, auseinanderhalten, so füllt sich die Blase, soweit sie nicht mit Flüssigkeit angefüllt ist, mit Luft, und nach Stillung der Blutung aus den Schnitträndern und Entfernung des Blutes und der vorher injicirten Flüssigkeit aus der Blase mittelst eines Irrigators, den man als Heberapparat benutzt, lässt sich nun das ganze Innere der Blase dem Auge zugänglich machen. Die Gegend des Trigonum liegt der Incisionsöffnung gegenüber unmittelbar zu Tage: ist eine Blasen-

<sup>11</sup> J. Veit, Über die Technik der Laparotomien. Berliner Klinik. Heft 15. 1889.

scheidenfistel vorhanden, so fällt dieselbe sofort in die Augen, man sieht nach vorn das Ostium internum urethrae und erkennt bald auch die beiden Ureterenmündungen auf ihrer Schleimhautfalte. Ist das Licht des Fensters nicht hell genug, so kann man mit Hohlspiegeln oder mit elektrischen Lämpchen (vgl. bei Eigenbrodt) nachhelfen.

Die beiden beigegebenen Photographieen, welche von Herrn Dr. Wendelstadt an Leichen aufgenommen sind, mögen das Gesagte veranschaulichen: die Leiche ist an den Beinen suspendirt, die Blase durch queren Schnitt an der Symphyse freigelegt und quer geöffnet, die Ränder der Blasenwunde sind mit den Rändern der Hautwunde provisorisch vernäht. Man sieht in der männlichen Blase die Katheterspitze aus dem Ostium internum urethrae herausragen, man sieht beide Ureterenmündungen, in welche feine Bougies eingeschoben sind. In der weiblichen Blase ist ein Loch in die Blasenscheidenwand geschnitten, um die Verhältnisse bei einer Blasenscheidenfistel anschaulich zu machen; die Scheide ist mit einem Schwamm ausgestopft und die Blasenscheidenwand dadurch nach der Blase zu in die Höhe gehoben.

Aus den Photographieen erhellt wohl ohne weiteres, wie leicht es ist, die Ränder der Blasenscheidenfistel anzufrischen und zu vernähen. Um dabei die lästigen Wundhaken und Specula los zu werden und jede Verletzung der Peritonealfalte auch bei etwaigen Brechbewegungen sicher (S. 3382) zu vermeiden, kann man den oberen Wundrand des Blasenschnittes mit dem oberen Wundrand des quer angelegten Hautschnittes durch einige Nähte provisorisch vernähen, während man den unteren Wundrand des Blasenschnittes durch Häkchen oder mittelst durchgezogener Fäden, an denen kleine Gewichte befestigt werden, bei Seite halten lässt.

Die Anfrischung geschieht in der gewöhnlichen Weise trichterförmig; liegt die Fistel in der Nähe der einen oder anderen Uretermündung, so schiebt man eine feine Sonde in den Ureter ein, um sicher zu sein, seine Mündung bei der Naht nicht mitzufassen.

Die Nähte, aus Fil de Florence, werden am bequemsten in der Blase geknotet und kurz abgeschnitten. Es bilden sich dann

aber leicht Inkrustationen oder vollständige Blasensteine an denselben, und ist es daher richtiger, die Fäden so durchzulegen, dass sie in der Vagina geknotet werden können.

Zu dem Ende wird der Faden an beiden Enden mit langen geraden oder schwach gebogenen Nadeln armirt, die Nadeln werden von der Blase aus nach der Scheide zu durchgestochen und hier von den Fingern der linken Hand aufgefangen. Das Knoten geschieht in der Scheide unter Kontrolle von der Blase aus. Will man in der Blase knoten, was, wie gesagt, viel bequemer ist, so muss man nicht mit Seide oder Fil de Florence, sondern mit Catgut nähen, welches im Bereich des Stichkanals resorbiert wird, sodass die Knoten in die Blase fallen und mit dem Urin entleert werden.

Nach vollendeter Fistelnaht bleibt es noch übrig, die Blasenwände von beiden Seiten her bis auf eine Drainöffnung in der Mitte durch Naht zu schliessen. Eingerissene Stellen der Wundränder werden mit der Scheere geglättet, auf die erste Nahtlinie, welche die Wundränder möglichst genau vereinigt, wird eine zweite Reihe Lembert'scher Nähte gelegt, so dass die Blasennaht die Form der Darmnaht nachahmt. In die übrigbleibende Drainöffnung wird ein T-förmiges Drainrohr eingehängt. Endlich wird auch die äussere Wunde bis auf 3 Drainöffnungen geschlossen, in der mittleren Drainöffnung liegt lose das Blasendrainrohr, durch die beiden lateralen Öffnungen wird der prävesikale Raum nachher mittelst Jodoformgazestreifen besonders drainirt.

Die Kranke wird nun in die horizontale Bauchlage gebracht und in derselben schwebend gehalten bis die Blase durch das T-förmige Drainrohr mit schwacher Sublimatlösung gründlich ausgewaschen ist, in die Vagina wird ein dünner Jodoformgazetampon eingelegt und die Patientin dann im Bett auf einem Wasserkissen in Seitenlage so gelagert, dass die vordere Bauchwand schräg nach unten sieht (Seitenbauchlage). Einige Spreukissen stützen den Rücken, alle Stunde oder alle zwei Stunden wird die Kranke von der rechten auf die linke und von der linken auf die rechte Seite umgelagert, um Druck am Trochanter zu verhüten.

(S. 3383) Die Wunde wird offen behandelt. Ein häufig gewechseltes Mooskissen oder ein Gazebausch fängt den abtropfenden Urin auf: sollte das Blasendrain sich mit einem Blutcoagulum verstopfen und der Urin auch nicht neben demselben frei abtropfen, so wird das Drainrohr durch den Wasserstrahl eines Irrigators vorsichtig frei gemacht, ebenso muss die Blase durch das Drainrohr vorsichtig und ohne grossen Druck irrigirt werden, wenn etwa Cystitis bestand oder sich in den nächsten Tagen bemerkbar macht. Sonst ist auch das Irrigiren überflüssig, und kann überhaupt vollständig abwartend verfahren werden.

Vom 5. Tage an darf die Kranke zeitweise die Rückenlage annehmen, am 9.-12. Tage wird das Blasendrainrohr entfernt und die Wunde heilt dann von selbst allmählich zu, mitunter stossen sich vorher noch einige nekrotische Fetzen von Fascien ab. Bald stellt sich Urindrang ein, wird derselbe befriedigt, so geht ein Theil des Urins durch die Urethra, ein Theil durch die Wunde ab, letztere Quantität wird immer geringer und etwa 20 Tage nach der Operation ist die Kontinuenz vollständig geworden. Dies der Verlauf bei glücklicher Heilung der Blasenscheidenfistel; geht die Naht wieder auseinander, so fliesst natürlich sofort sämmtlicher Urin wieder durch die Scheide ab.

Ein Einwurf bedarf noch der Besprechung, welcher gegen mein Verfahren vielleicht erhoben werden könnte. Auch die vollständige Gefahrlosigkeit des hohen Steinschnittes bei richtiger Ausführung und Behandlung zugegeben, könnte man die Befürchtung haben, dass die vollständige Heilung der Steinschnittwunde ausbleiben und eine Fistel oberhalb der Symphyse zurückbleiben könnte. Diese Befürchtung ist unbegründet, falls es nur gelingt, den Urin unzersetzt und von saurer Reaktion zu erhalten. Bei über 50 von mir ausgeführten hohen Steinschnitten kam es nur in wenigen Fällen zur Bildung einer Blasenfistel und zwar nur dann, wenn—bei grossen Carcinomen—eine schwere Cystitis bestand, welche den Urin alkalisch machte, oder wenn die Urinentleerung durch die Urethra dauernd behindert blieb, wie bei Prostatikern, die auch schon vor der Operation nur mit Hilfe des Katheters hatten uriniren können. In allen anderen

Fällen kamen auch grosse Incisionswunden in der Blase mit entsprechend grosser äusserer Incision sicher zur Heilung ohne Fistel. Auf die Bedeutung der saueren Reaktion des Urins für die Heilung von Blasen fisteln ist schon von Roser hingewiesen worden und ist auf diesen Punkt bei der Nachbehandlung zu achten. Ausspülungen der Blase mit lauwarmem Wasser, Injektionen von *Argentum nitricum* in einer Lösung von 1:1000–1:500, und der innerliche Gebrauch von *Acidum camphoratum* (1 gr mehrmals täglich) sind besonders wirksam, Zersetzung des Urins zu verhindern und zu beseitigen. Vornehmlich die Kamphersäure ist ein unschätzbares Mittel.

Der einzige Übelstand bei dem hohen Steinschnitt, zumal mit (S. 3384) queren Hautschnitt und Ablösung der Rektum an der Symphyse, besteht in der Möglichkeit, dass in der Narbe sich später ein kleiner Bauchbruch entwickelt. Diesen Übelstand werden aber Arzt und Patientin einer sonst unheilbaren Blasen scheidenfistel gegenüber gern in den Kauf nehmen.

Die Drainage der Blase in den ersten 8–14 Tagen nach der Operation halte ich für einen unentbehrlichen Theil des ganzen Verfahrens. Die Fistelnaht wird durch die Ableitung des Urins für die ersten entscheidenden Tage vollständig trocken gelegt, Blasenkrämpfe werden verhütet, alles Katheterisiren wird vermieden und wir haben zugleich in der Blasendrainage die Möglichkeit, das Innere der Blase wenn erforderlich schonend zu irrigiren und mit Medikamenten zu behandeln. Alle diese Vortheile dürfen nicht aufgegeben werden.

Sich den Zugang zur Blase durch eine partielle Resektion an der Symphyse zu bahnen (Helferich und König<sup>12</sup>) halte ich für nicht sehr zweckmässig. Man erreicht damit nicht mehr, als mit der einfachen Beckenhochlagerung, sie ist der Schlüssel zum Innern der Blase.

Was die Indikationsstellung anbetrifft, so ist die vesikale Operationsmethode besonders für hoch und versteckt liegende, von der Scheide aus nicht gehörig freizulegende Blasen scheidenfisteln zu empfehlen, besonders für Fisteln in der nächsten Nähe der Ureteren, weiterhin für alle Blasen-Gebärmutterfisteln,

<sup>12</sup> Vergl. Verh. d. Deutsch. Gesellsch. f. Chir. 1888. XVII. II. 116 ss. u. I. 100 ss.

Ureter-Cervixfisteln und Ureterscheidenfisteln. Letztere werden sich in allen Fällen von der Blase aus leichter und sicherer operiren lassen, als von der Scheide aus, die Blasengebärmutterfistel wird bei Anwendung der vesikalen Methode keine grösseren Schwierigkeiten bieten, als eine gewöhnliche kleine Blasenscheidenfistel, und die Ureterscheidenfistel wird sich durch Aufschlitzen des Ureters von der Blase aus voraussichtlich ebenfalls leicht zugänglich machen lassen. Vielleicht wird das Aufschlitzen der Uretermündung allein schon ausreichen, um die Heilung der Fistel zu Stande kommen zu lassen, wie die Speichelfistel sich mitunter ohne plastischen Verschluss von selbst schliesst, wenn der Speichel durch das Verfahren von Deguise in den Mund abgeleitet wird.

Wenn ich bei meinen beiden ersten Versuchen der Blasenscheidenfisteloperation von der Blase aus<sup>13)</sup> keinen Erfolg erzielte und schliesslich zur Kolpokleisis übergehen musste, so lag dies an der ungewöhnlichen Grösse der Defekte und der narbigen Fixation ihrer Ränder an der Symphyse. Die Methode als solche befriedigte mich vollständig und ich beschloss, sie für geeignete Fälle im Auge zu behalten.

Am. 1. Juli d. J. nun ging mir durch die Güte des Herrn Dr. Zumwinkel in Laar bei Ruhrort eine 44 jährige Frau polnischer Abkunft zu, welche seit einer Entbindung vor 15 Jahren an Abträufeln des Urins aus der Scheide litt. Dass Kind war das fünfte gewesen und mit der (S. 3385) Zange extrahirt worden. Die Untersuchung ergab Folgendes: Im vorderen Scheidengewölbe nach rechts von der Mittellinie befindet sich ein mit der Längsaxe von rechts und vorn nach links und hinten verlaufender ovaler Defekt von der Grösse etwa eines kleinen Pflaumenkernes, durch den sich die Kuppe des Zeigefingers in die Blase einschieben lässt. Die rechte Hälfte der Portio fehlt, der Rest ist schief gestellt, so dass der Eingang in den Cervikalkanal mit der Sonde nicht aufzufinden ist. Der Fundus uteri ist nach links hinten oben gerichtet. Wegen narbiger Fixation gelingt es nicht, Uterus und Fistelrand herabzuziehen.

Operation am 2. Juli 1888:

<sup>13</sup> Vergl. bei Meyer l. c.

Narkose, Beckenhochlagerung mit Hilfe des Eschbaum'schen Apparates. Etwa 10 cm langer Querschnitt am oberen Rande der Symphyse. Abtrennung der Rekti von der Symphyse, Eröffnung des prävesikalen Raumes. Einführung eines Katheters in die Blase, quere, 5–6 cm lange Incision in die vordere Blasenwand unterhalb der Peritonealfalte. Der obere Rand der Blasenwunde wird durch einige provisorische Nähte an den oberen Rand der Hautwunde angenäht, durch den unteren Blasenwundrand werden einige Fäden durchgezogen, welche, mit herabhängenden Schiebern beschwert, den Wundrand nach unten und nach den Seiten ziehen. Man erblickt nun sofort den schräg gestellten ovalen Defekt der Blasenscheidenwand zwischen beiden Ureterenmündungen, der rechten Uretermündung näher gelegen als der linken. Am oberen Fistelrande, der mit dem Rest der Portio innig zusammenhängt, lässt sich die Uterussonde in den Cervikalkanal einschieben und zwar in der Richtung nach oben links und hinten.—

Die scharfen Ränder der Fistel werden nun trichterförmig angefrischt, so dass von der Blasenschleimhaut ein breiterer Streifen, von der Scheiden- und Cervikalschleimhaut nur ein schmaler Saum entfernt wird, die Anfrischungsfläche in der Blase hat links die Breite von etwa 1 cm, rechts kann sie wegen der Nähe der Uretermündung nur 5–6 mm breit werden.— Sodann werden 6 Nähte von Fil de Florence angelegt mittelst gewöhnlicher krummer Nadeln und eines gewöhnlichen Nadelhalters; die einzige kleine Schwierigkeit dabei ist, die dicht neben der Anfrischung liegende Uretermündung wiederzufinden und bei der Naht sicher zu vermeiden. Sie wird daher durch eine eingeschobene feine Sonde markiert. Das Knoten der Nähte in der Blase lässt sich so bequem ausführen wie bei einer gewöhnlichen Hautnaht an der Körperoberfläche. Nach Schluss der Nähte liegt der Eingang in den Cervikalkanal in der Scheide.

Endlich werden die provisorischen Nähte am oberen Rande der Blasenwunde wieder getrennt und beide Wundränder der Blase durch einfache Knopfnähte und Lembert'sche Nähte von den Seiten her nach der Mitte zu vereinigt. In der Mitte bleibt eine kleine Öffnung, in welche das T-förmige Blasendrain eingehängt wird. Ausspülung der Blase in (S. 3386) Bauchlage mit

Sublimatlösung 1"5000, Naht der Hautwunde bis auf die mittlere und zwei seitliche Drainöffnungen.

Lagerung in Seitenbauchlage. Verlauf der Heilung ein fast reaktionsloser, höchste Temperatur am 4. Tage: 38,4.—Urin wenig getrübt. Ausspülungen, Acid. camphor. innerlich.—Entfernung des Blasendrains am 16. Tage. Kein Urin mehr durch die Steinschnittwunde vom 21. Tage ab. Urin kann  $\frac{1}{2}$  Stunde gehalten werden.—4 Wochen nach der Operation: Urin kann 1 Stunde gehalten werden.—7 Wochen nach der Operation: Wunde geschlossen. Urin wird 2–3 Stunden gehalten.—

Nach ihrer Entlassung aus der Klinik traten neue Beschwerden ein: der Urindrang wurde häufiger und schmerzhaft. Blasenkrämpfe stellten sich ein. Herr Dr. Zumwinkel fand bei einer Untersuchung am 17. September Konkreme in der Blase, dilatirte deshalb am 21. Sept. in der Narkose die Urethra und extrahirte mehrere der hinteren Blasenwand aufsitzende über erbsengrosse Konkreme. Dieselben mussten mit den Fingern von der Blasenwand losgerissen werden, mit ihnen gingen die Fäden von Fil de Florence ab, mit denen die Fistel geschlossen worden war. Eine sehr festsitzende Naht liess sich nicht herausbefördern. Einige kleinere Konkreme sassen an der vorderen Blasenwand.

Die Fistel ist aber verschlossen und die Kontinenz erhalten geblieben.

Der letzte Zwischenfall lehrt, dass die Fistelnähte bei Anwendung eines nicht resorbirbaren Nähmaterials nicht in der Blase geknotet werden dürfen, wozu ich mich durch die grössere Bequemlichkeit des Verfahrens hatte verleiten lassen, dass sie vielmehr in der Scheide geknotet werden müssen, wie ich es auch in meinen beiden ersten Fällen gemacht hatte. Auch die Blasennaht im Bereich der Steinschnittwunde muss so genäht werden, dass kein Fadenende in die Blase hineinragt, wenn man nicht auch hier—was am Vortheilhaftesten sein wird—mit Catgut nähen will.<sup>14</sup>

<sup>14</sup> Inzwischen habe ich die beschriebene Methode mit Knoten der Fäden in der Scheide in einem weiteren Fall mit vollständigem Erfolge angewandt.



Der Verschluss einer Blasenscheidenfistel durch Lappentransplantation ist kein ganz neues Verfahren. Von Jobert, Roux, Wutzer u. A. wurden Operationen der Art ausgeführt, oder, besser gesagt, Operationsversuche unternommen. Denn ein ganz sicherer Fall von Heilung einer Blasenscheidenfistel durch Lappentransplantation lässt sich in der älteren Litteratur nicht auffinden.

Jobert schnitt ein ovales gestieltes Hautstück aus der grossen Schamlippe, klappte es, die Wundseite nach aussen, der Länge nach zusammen und stopfte es nun als organischen Pfropfen in die wundgemachte Fistel. Fäden, welche zur Harnröhre herausgeführt wurden, sollten den Pfropfen (S. 3387) in der Fistel festhalten. Der Pfropfen entschloss sich nicht dazu einzuheilen. Ein ähnlicher Versuch mit einem Hautlappen, welcher der Gesässfalte entnommen war, soll geglückt sein.<sup>15</sup> Velpeau empfahl, die Scheidenhaut brückenförmig abzutrennen und über die Fistel zu verschieben. Wutzer<sup>16</sup> nähte einen 3" langen, 2" breiten und mit einem 2" langen Stiel versehenen Lappen von der inneren Fläche des Oberschenkels in einen grossen Defekt der Blasenscheidenwand ein, der Stiel wurde in eine Incision durch grosse und kleine Schamlippe eingenäht; der Lappen wurde brandig. Vorher hatte Wutzer bei derselben Patientin den Versuch gemacht, die Scheide unterhalb der Fistel mit einem der hinteren Vaginalwand entnommenen gestielten Lappen zu verschliessen, was ebenfalls nicht gelungen war. Szymanowski<sup>17</sup> erwähnt diesen Fall so, dass der Leser glaubt, Wutzer habe diesen Lappen aus der hinteren Scheidenwand in den Defekt selbst transplantirt, was aber nicht der Fall gewesen ist, es handelte sich um einen Versuch der Kolpokleisis.

Dieffenbach erklärte alle Versuche des Fistelverschlusses durch Lappen aus der äusseren Haut für irrationell und wandte sich ganz dem älteren, von Roonhuysen (1663) zuerst vorgesch-

<sup>15</sup> Zeis. Handbuch der plast. Chir. 1838, p. 532 ss.

<sup>16</sup> C. W. Wutzer, Über Heilung der Blasenscheidenfistel mit Hülfe der Punktion der Blase. Organ f. d. gesammte Heilkunde. II. 4. 1 ss. 1843.

<sup>17</sup> v. Szymanowski, Handbuch d. operativen Chirurgie. I. p. 375.

lagenen Verfahren der Anfrischung und Naht zu. Seitdem sind jene Transplantationsversuche fast ganz der Vergessenheit anheimgefallen und auch ihr stolzer Name Elytroplastik ist verklungen. Winckel erwähnt sie in seiner Monographie überhaupt nicht.

In neuester Zeit hat Fritsch<sup>18</sup> die untere Wand der Harnröhre mit Erfolg durch einen Lappen aus der kleinen Schamlippe ersetzt. Rydygier<sup>19</sup> entwarf sich in einem Fall von ausgedehnten Defekt der Blasenscheidenwand den Plan, den Defekt durch einen Lappen aus der hinteren Scheidenwand zu ersetzen. Zu dem Ende wurde, um einen Stiel für den Lappen zu gewinnen, zunächst am unteren Fistelrande die vordere mit der hinteren Scheidenwand vereinigt, später sollte oberhalb dieser Stelle dem Defekt gegenüber der Lappen aus der hinteren Wand ausgeschnitten werden. Die Patientin war aber mit der queren Obliteration der Scheide, welche die Folge des ersten Operationsaktes war, so zufrieden, dass sie nicht wieder erschien, und der Operationsplan kam daher nicht zur Ausführung. Er würde wohl auch schwerlich mit Erfolg (S. 3388) zur Ausführung zu bringen gewesen sein, denn wie soll man oberhalb der queren Obliteration und ohne dieselbe ganz wieder zu trenne, Raum finden, einen korrekten plastischen Lappen aus der hinteren Wand auszuschneiden?

Im Anschluss an diesen Fall macht Rydygier einen zweiten Vorschlag für ähnliche Fälle. Es soll von der hinteren Scheidenwand ein zungenförmiger Lappen mit unterer Basis abgelöst, nach vorne dislocirt und, mit der Schleimhautseite nach der Blase zu, in den oberen Theil des Defektes eingenäht werden. In einem zweiten Operationsakt soll am unteren Fistelrand die quere Obliteration der Scheide ausgeführt werden, aber nicht in der ganzen Ausdehnung der Scheide, sondern nur entsprechend

<sup>18</sup> Fritsch. Centralbl. f. Gynäkol. 1887. Nr. 30.—Die in Centralbl. f. Gyn. 1888. Nr. 49 erwähnten Operationen gehören nicht hierher, da es sich bei der »Lappenbildung« nur um Verziehung der unterminirten Ränder, nicht um eigentliche Lappentransplantation handelt.

<sup>19</sup> Berl. klin. Wochenschr. 1887. Nr. 31. Nach einem Vortrag geh. auf d. Naturforschervers. Berlin. 1886.

der Breite der Fistel. Endlich soll unterhalb der Obliterationsstelle die hintere Scheidenwand quer eingeschnitten, der Lappen ganz von der Unterlage abgelöst und mit seinen unteren seitlichen Partien in den unteren Theil der Fistel eingeheilt werden. Durch Einlegen von Jodoformgazestreifen soll das Wiederanheilen des abgelösten Lappens an die hintere Scheidenwand verhindert werden.

Ob es überhaupt möglich ist, in der von Rydygier vorgeschlagenen Weise einen so grossen, die Portio vaginalis in sich einschliessenden Defekt zum Verschluss zu bringen, scheint mir recht zweifelhaft zu sein. Schon bei dem ersten Akt wird es technisch sehr schwierig sein, den oberen Rand des Lappens so genau an den oberen Rand der Fistel anzunähen, dass prima intentio zu erwarten ist.

Ich würde auf jeden Fall den hohen Steinschnitt mit breiter Eröffnung der Blase vorausschicken, um den oberen Fistelrand mit dem Reste der Portio exakt anfrischen und den Lappenrand exakt annähen zu können, während das Ausschneiden des Lappens natürlich von der Scheide aus zu geschehen hätte. Von der Blase aus würde der Lappen sich gleich im ersten Operationsakt nicht nur oben, sondern auch an den Seiten einnähen lassen und es bliebe dann nur noch das Ablösen des Lappens und Einnähen seines Stieltheils in den unteren Fistelrand von der Vagina (ohne vorherige Obliteration der Scheide) als zweiter Akt übrig. Würde die Nahtlinie dann durch Drainage der Blase für längere Zeit trocken gelegt, so liesse sich vielleicht Einheilung erwarten.

Aber mit solchen Vorschlägen ist nicht allzuviel gewonnen, der erfolgreiche Versuch allein entscheidet.

Günstiger für Transplantationen liegen die Verhältnisse bei kleinerem, nicht so weit nach oben reichendem Defekt. Man ist dann bei der Anheftung des Lappens nicht auf den dünnen narbigen Rand der Fistel beschränkt, sondern kann die ganze Umgebung der Fistel zur Implantation des Lappens mitbenutzen, indem man die Umgebung der Fistel in einem breiten Ring anfrischt, und nun das Ganze mit einem entsprechend grossen Lappen deckt, der mit der Wundseite der Blase zugekehrt ist

(S. 3389) und mit seiner Wundfläche auf jener ringförmigen Wundfläche aufliegend die Fistel nach allen Seiten hin breit überdeckt.

Bei anderen schwer zu beseitigenden Fisteln, besonders bei Harnröhrenfisteln bei Männern, am Damm oder am Penis, hat sich mit dieses Verfahren der Fisteldeckung mit einem gestielten Lappen aus der Nachbarschaft als sehr brauchbar erwiesen.

Um ganze Umgebung der Fistel wird in der Breite von wenigstens 1 cm ringsum angefrischt und der gestielte zungenförmige Lappen aus der benachbarten Haut—also vom Scrotum, von der Inguinalgegend, vom Oberschenkel—so gross gebildet, dass er nach seiner Zusammenziehung in die kreisrunde Wundfläche genau hineinpasst. Zwischen der Anfrischungsfläche und dem sekundären, durch Abpräparieren des Lappens entstehenden Defekt bleibt ein Sporn stehen, wie bei der Langenbeckschen Cheiloplastik, der Lappen wird über den Sporn hinübergehoben, in den Defekt eingepasst und mit seinem Rande an den Rand der Anfrischungsfläche, resp. des Sporns angeheftet. Der Fistelrand wird mit angefrischt, im Übrigen braucht man sich garnicht um ihn zu kümmern. In früherer Zeit haben Cooper, Philipps und Delpech ähnliche Operationen zur Heilung von Harnfisteln bei Männern angewandt.<sup>20</sup>

Nach Analogie dieses Verfahrens bei Harnfisteln am Penis oder Damm müsste man den Lappen bei Blasenscheidenfisteln aus der vorderen Vaginalwand entnehmen. Bei ganz kleinen Fisteln—welche aber wohl immer durch die Simon'sche Methode zu heilen sind—wäre dies auch möglich. Bei etwas grösseren Defekten wird es schwer sein, nach genügend breiter Anfrischung in der Umgebung noch einen genügend grossen Lappen aus der vorderen Scheidenwand zu gewinnen. Dagegen steht die ganze hintere Scheidenwand in bequemster Weise zur Verfügung.

Allerdings müssen wir bei Benutzung derselben das Indische Verfahren—Transplantation aus der benachbarten Haut—verlassen, und zu der Methode von Tagliacozzi übergehen, aber für die Durchführung dieser Methode haben wir so günstige Bedingungen wie nur möglich. Die hintere Scheidenwand liegt der vorderen Scheidenwand von selbst an, wir brauchen also nicht

<sup>20</sup> Czerny, Arch. f. klin. Chir. XXI. 1. p. 65 ss.

wie bei der Rhinoplastik den einen Körpertheil erst an den anderen heranzuführen und künstlich zu befestigen; bilden wir einen hufeisenförmigen Lappen mit unterem breiten Stiel aus der hinteren Scheidenwand und klappen denselben ganz herunter, so dass seine Wundseite nach vorne sieht, so wird er sich ganz von selbst mit seiner Wundfläche gegen die Anfrischungsfläche in der vorderen Scheidenwand anlegen, und, an seinem freien Rande mit dem unteren und seitlichen Rande der Anfrischungsfläche vernäht, leicht aufheilen. (S. 3390) Später muss dann die Brücke durchschnitten werden und der untere Theil des so vollständig abgelösten Lappens nach erneuter Anfrischung des oberen Randes des Defektes und seiner Nachbarschaft hier angeheftet werden. Der ganze Lappen der hinteren Scheidenwand ist so nach der vorderen Scheidenwand hinübergewandert, seine Schleimhautseite sieht nach wie vor in die Scheide und sein oberer Rand ist nach unten, sein unterer Rand nach oben gekommen.

Diesen Operationsplan brachte ich am 21. März 1887 bei einer Blasenscheidenfistel zur Ausführung, welche theils von mir, theils von Anderen nach der Simon'schen Methode 7 mal ohne Erfolg operirt worden war.<sup>21</sup>

Die Fistel, für die Kuppe des Zeigefingers eben durchgängig, lag in dem untersten Abschnitt der Blase, dicht über dem ostium internum urethrae; also an einer Stelle, wo Blasenscheidenfisteln sehr leicht zugänglich zu machen, aber oft schwer zum Verschluss zu bringen sind.<sup>22</sup> Die Ränder waren in Folge der früheren misslungenen Operationen narbig indurirt. Bei diesen Operationen hatte sich neben der Spannung der Naht die ungewöhnlich grosse Reizbarkeit der Blase als ein wesentliches Hindernis der Heilung erwiesen; die Frau hatte jedesmal unaufhörlichen Drang zum Wasserlassen und schmerzhaftes Blasenkrämpfe bekommen, so dass sehr häufig katheterisirt werden musste; den Verweilkatheter hatte sie auch nicht vertragen.

Der erst Akt der Operation bestand nun darin, dass die Umge-

<sup>21</sup> Vergl. Correspondenzbl d. ärztl. Vereine in Rheinland u. Westph. 1887. Sept.

<sup>22</sup> G. Simon, Zur Operation der Blasenscheidenfistel. Wien medic. Wochschr. 1876. Nr. 27 ss.

bung der Fistel, einschliesslich des Fistelrandes, gut 1 cm breit angefrischt wurde, doch nur nach unten (vorn) und nach den Seiten hin, während der obere Rand und seine Umgebung unberührt gelassen wurde. Die Figur der Anfrischungsfläche zusammen mit der Fistel entsprach also etwa der Fläche eines Halbkreises mit einem Radius von  $1\frac{1}{2}$ –2 cm. Sodann wurde das Simon'sche hintere Speculum soweit aus der Scheide zurückgezogen, dass die hintere Scheidenwand sich gegen die Anfrischungsfläche an der vorderen Scheidenwand anlegte, und an der den untersten Punkt der Anfrischungsfläche berührenden Stelle der hinteren Scheidenwand wurde ein Vermerk mit dem Messer gemacht. Nun wurde ein vorderes Speculum eingelegt und auf der hinteren Scheidenwand ein etwa 4 cm breiter, 4–5 cm langer hufeisenförmiger Lappen mit unterem 4 cm breiten Stiel so ausgeschnitten, dass der erwähnte blutende Vermerk unterhalb der Mitte des Stieles lag. Der Lappen wurde vorsichtig abpräparirt und ganz herunter geklappt, so dass der Stiel eine quere Umschlagsfalte bildete und die Wundfläche des Lappens nach vorne sah. Der dadurch entstandene blutende Defekt der hinteren Scheidenwand wurde durch Nähte von oben her theilweise wieder geschlossen. Mit (S. 3391) Leichtigkeit liess sich nun der vorher obere, jetzt untere Rand des Lappens mit dem unteren Rande der Anfrischungsfläche vernähen, ebenso der untere Theil seiner seitlichen Ränder mit den seitlichen Rändern der Anfrischungsfläche. Neben dem nicht vernähten Stiel blieb jederseits eine Öffnung frei für den Abfluss des Urins und der menses. Hier wurden Jodoformgazestreifen lose eingelegt.

Die Heilung kam im Bereich der ganzen Nahtlinie per primam zu Stande, und auch der Fläche nach heilte der Lappen soweit auf, dass ein Theil der Fistel gedeckt war.

Vier Wochen später wurde der Stiel des Lappens mit einem nach unten stark konvexen queren Schnitte umschnitten und von der hinteren Scheidenwand abgetrennt. Der Lappen sass also jetzt dem unteren Theil des Fistelrandes und seiner Umgebung so auf, wie der Tagliacozzi'sche Nasenlappen der Nasenwurzel nach Abtrennung des Lappens vom Arm. Sein freier Rand liess

sich mit Häkchen leicht soweit hervorziehen, dass der Rest der Fistel und die z. Th. übernarbte, z. Th. noch granulirende frühere Wundfläche des Lappens freigelegt wurden. Ebenso gelang es ohne Schwierigkeit, mit Messer und Scheere die alte Wundfläche des Lappens und die noch nicht gedeckte Umgebung des oberen Fistelrandes anzufrischen, der losgelassene Lappen legte sich mit seiner blutenden Fläche gegen die blutende Fläche an der vorderen Scheidenwand und wurde hier eingenäht. Er war so, auf den Kopf gestellt, ganz von der hinteren nach der vorderen Scheidenwand hinüber gewandert.

Um das Einsickern des Urins unter den Lappen und jede Blasenreizung durch Katheterisiren zu verhüten, wurde die Blase schliesslich in Beckenhochlagerung oberhalb der Symphyse eröffnet und in die kleine Öffnung ein Drainrohr eingehängt. Im Bett wurde die Kranke in Seitenbauchlage gebracht.

Der Heilungsverlauf war ein ganz ungestörter, der Urin tropfte, so lange das Drainrohr lag (etwa 10 Tage), durch die Steinschnittwunde ab, inzwischen heilte der Lappen vollständig an und nach Schluss der Steinschnittwunde erfreute sich die Patientin vollständiger Kontinenz.

Seit der Zeit hat sie eine zweite Entbindung glücklich überstanden. In der Narbe oberhalb der Symphyse hat sich ein kleiner Bauchbruch entwickelt, dessentwegen die Frau eine Bandage trägt.

Von wesentlicher Bedeutung für das Zustandekommen der Heilung war in diesem Falle augenscheinlich die Drainage der Blase oberhalb der Symphyse, durch welche das Operationsfeld trocken gelegt und relativ aseptisch erhalten wurde.

Bei linear vereinigter Fistel ist die zeitweise Füllung der Blase mit Urin bekanntlich kein Hindernis der prima intentio, da der Urin bei gut schliessender Naht überhaupt nicht in die Wundspalte eindringen kann. Wo es sich dagegen um die Aufheilung eines Lappens auf eine (S. 3392) grössere Wundfläche in der Umgebung der Fistel handelt, liegt die Sache ganz anders. Der Urin würde, mit Wundsekret vermischt, durch die offene Fistel zwischen Lappenwundfläche und Anfrischungsfläche hindurch in die Scheide abrieseln und die Aufheilung des Lappens wahr-

scheinlich vereiteln. Prima intentio ist nur bei Trockenlegung der Wunde zu erwarten.

Schon Wutzer suchte ein solches Ziel zu erreichen, indem er von der Blase aus einen gekrümmten Troicart dicht an der Symphyse durch die vordere Blasenwand und die Bauchwand in der Mittellinie durchstiess und die Kanüle des Troicarts in dem Stichkanal so weit durchzog, dass ihr eines Ende in der Blase lag, während das andere oberhalb der Symphyse herausstand. Seine Patientinnen mussten dann, auf einem besonderen Lagerungsapparat unverrückbar aufgeschnallt, auf dem Bauche liegen bleiben und die silberne Kanüle wurde durch einen an dem Apparat angebrachten Röhrenhalter in der Blase unbeweglich festgehalten. Dies war natürlich ein sehr quälendes, ganz unsicheres, für unsere heutigen Begriffe ungeschicktes Verfahren. Aber man muss bedenken, dass es damals noch keine Gummidrainröhren gab! Dem richtigen Gedanken mussten, wie so oft, die Fortschritte der Technik erst die richtigen Hilfsmittel and die Hand geben, ehe er nutzbringend werden konnte.

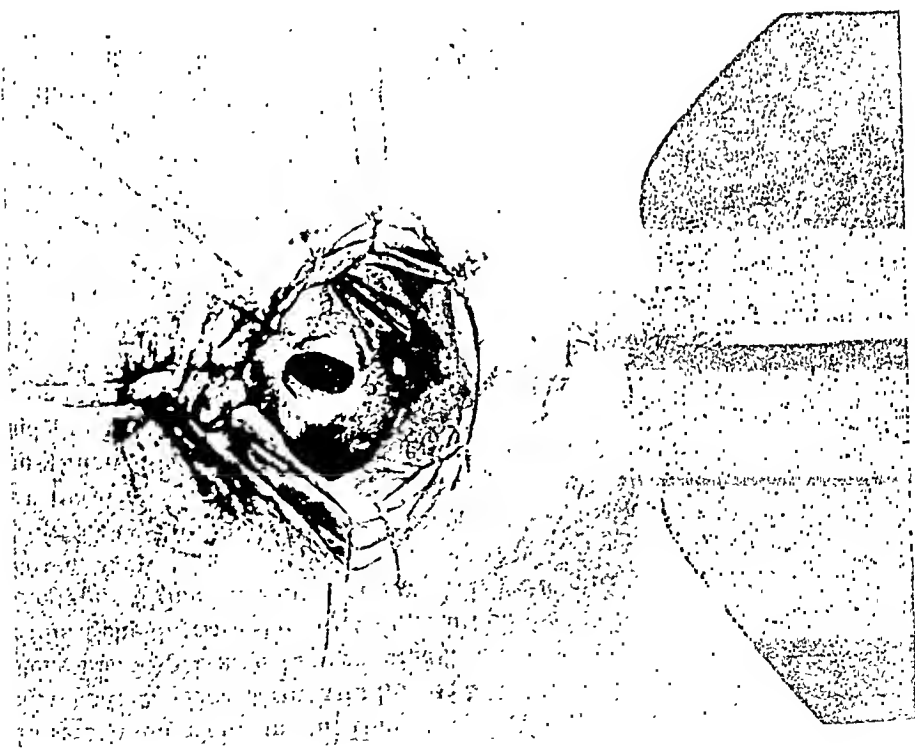
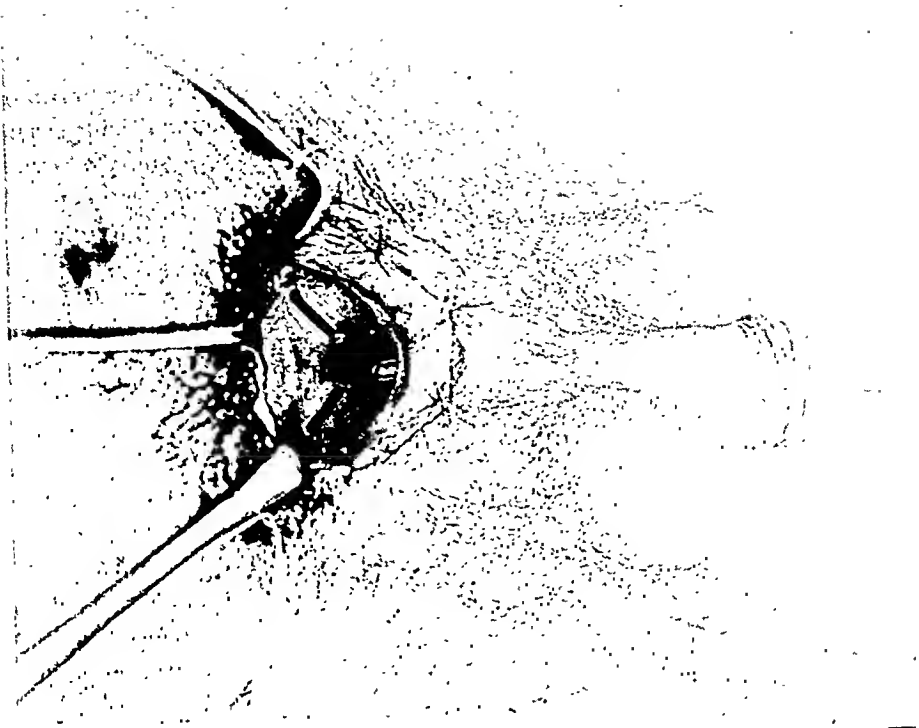
Ein lose in die Blase eingehängtes T-förmiges Gummidrain, wie wir es jetzt anwenden, genirt die Patientin in keiner Weise, auch die Seitenbauchlage (natürlich ohne jede Fesselung) ist keine allzugrosse Belästigung, und es ist ein grosser Vortheil für die ungestörte Verklebung der Wunde und eine grosse Annehmlichkeit für die Patientin, wenn alles Katheterisiren entbehrlich gemacht wird. Bei grosser Empfindlichkeit der Blase, wie sie bei unserer Patientin bestand, würde die Blasendrainage daher auch nach Anwendung der Simon'schen Methode zu empfehlen sein.

Fragt man nach den Indikationen zu der Methode der Lap-pentransplantation aus der hinteren Scheidenwand, so lässt sich eine ganz bestimmte Antwort darauf nicht geben. Sie ist zu empfehlen für nicht zu grosse, nicht zu hochliegende Blasenscheidenfisteln, bei denen die Simon'sche Methode wegen zu grosser Nahtspannung nicht zum Ziele führt, besonders zur Nachoperation nach theilweise gelungener Simon'scher Operation, um die zurückgebliebenen, so unangenehmen, kleinen, von rigiden Narben umgebenen, schmalrandigen Fisteln zum Verschluss



zu bringen, welche sich bekanntlich auch nach Bozeman'scher Vorkur dem Verschluss durch direkte Vereinigung oft hartnäckig widersetzen.—

Beide Methoden, die vesikale Methode und das Transplantationsverfahren, werden, wie ich hoffe, dazu beitragen, dass Kolpokleisis, Metrokleisis und Nierenexstirpation bei Harnfisteln in Zukunft immer seltener nothwendig werden.





# Operations for Vesico-Vaginal Fistula and the Elevated Pelvic Position for Operations within the Abdominal Cavity

BY  
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*in Bonn*

*With one photographic plate*

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THE operation for vesico-vaginal fistula has been brought to such a high degree of perfection since its origination by Naegle, Dieffenbach and Jobert de Lamballe, especially through the operative skill and the tireless persistence of Gustave Simon, that this chapter of gynecological surgery, at first glance, would appear to be closed almost completely. The more recent proposals are concerned with modifications of instruments, the position of the patient and the suture material, the preparations for operation and the post-operative care; the principle of the operation remains the same: exposure and freshening of the fistula from the vagina, closure with sutures by direct approximation of the margins in various figures adapted to the form and size of the defect. In skillful and experienced hands the method attains its end in

the large majority of cases; and, for all the ordinary cases of vesico-vaginal fistula, to replace the simple procedure would be a superficial artificiality.

Along with the majority of favorable cases, however, there is a small number of unfavorable ones, in which this method has to struggle against very weighty difficulties, and not rarely fails entirely in spite of repeated operative attempts. Winckel<sup>1</sup> estimates that about one-tenth of all women with urinary fistulae remain uncured.

The vesico-vaginal-uterine fistulae and the uretero-vaginal fistulae, above all, belong to the unfavorable cases of urinary fistulae; most especially the vesico-uterine fistulae, which can not be attacked by the method of direct closure from the vagina.

Also in the case of vesico-vaginal fistulae proper all sorts of difficulties can occur to prevent the success of the operation. Cicatricial stenoses of the vagina render access to the fistula difficult, adhesions to the pelvis make it impossible to bring down the uterus and the vesico-vaginal septum, the proximity of the ureter prohibits a satisfactorily productive freshening of the margins of the fistula, or the size of the defect and its unfavorable position close to the urethra does not allow approximation of the margins without troublesome tension. Under certain conditions these difficulties can be so great, that the fistula can be made smaller easily by the operation, but not completely closed.

An incomplete cure, however, does not usually improve the lot of the woman in the least, as the urine dribbles from the vagina as before. As a last resort only closure of the vagina remains, which puts an end to the trouble by substituting another infirmity in its place—a testimonial to the limitations of plastic surgery.

Under the present method of distributing the operative gynecological material, proportionately few, and, indeed, preferably the unfavorable cases reach the surgical clinic; therefore I can claim fame for no very broad experience in operations for vesico-

<sup>1</sup> Winckel, *The Diseases of the Female Urethra and Bladder*. *Deutsche Chir.* 62, 1885.

vaginal fistula. On the other hand, I have several times had cause to attack the problem with the active interest of finding other ways of closure of unfavorable cases than those usually followed.

My experience has led to practical results in two quarters. It has shown:

- (1) that fistulae which are not satisfactorily accessible from the vagina, can be exposed, freshened and sutured via the bladder with good results.
- (2) that fistulae which can not be closed by direct union of the margins, under some conditions, can be closed by covering with a flap from the posterior wall of the vagina.

#### I.

The operation on a vesico-vaginal fistula from the bladder would be regarded by Jobert and Dieffenbach, and probably also by G. Simon as a rash undertaking; but anyone who has followed the course of bladder surgery during the last ten to fifteen years will fall in with the idea easily. During this time the previously feared high section for calculus in its improved form has been shown to be almost without danger, we have thus convinced ourselves that large wounds of the bladder wall are easily cured by suturing, and the elevated pelvic position has placed in our hands a means of operating in the interior of the bladder under direct vision as conveniently or more conveniently than in the vagina. Thus nothing could be more natural than to undertake an attack through the bladder in the case of fistulae which are not to be handled successfully from the vagina.

My first, indeed unsuccessful, attempts in this direction (1881 and 1884)<sup>2</sup> have remained quite unnoticed. Only König has repeated them.<sup>3</sup> This is to be explained by the fact that the "elevated pelvic position," which alone is able to so expose the interior of the bladder that delicate operations in the bladder

<sup>2</sup> Willy Meyer. On the After-Care of High Lithotomy. Arch. f. klin. Chir. 1885. Bd. XXXI. p. 521.

<sup>3</sup> König. Verhandlung der Deutschen Gesellsch. f. Chirurgie. XVII. 1888. p. 100.

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can be performed, also has escaped notice for a long time, which further strengthens my conviction.

Therefore, in a few words, I should like to call special attention to the nature and advantages of this procedure once more.

If one places the body of a patient on the operating table in such a way that the symphysis pubis forms the highest point of the trunk and the long axis of the trunk forms an angle of at least 45 degrees with the horizontal, then the various organs, especially the liver, spleen and mesentery fall into the concavity of the diaphragm by virtue of their weight. The intestine follows and falls out of the true pelvis as far as the atmospheric pressure will permit. In the case of thin individuals and relaxed recti muscles in deep narcosis, the anterior wall of the abdomen in the hypogastric region in this way exerts a truly sucking effect on the pelvic cavity, so that in the latter region a deep space is formed.

If now a longitudinal or transverse incision is made in the hypogastric region for the purpose of lithotomy and the recti as well as the fascia lying behind them are split, then air at once enters the prevesical space, often with an audible sound, the peritoneal fold drops down and an extensive hollow space is formed from the prevesical interstitial space, into which the light readily shines and in which the eye can detect the anterior wall of the bladder and the reflected fold of the peritoneum. One introduces two fingers of the left hand into the wound in order to protect the peritoneum, and can now incise the anterior bladder wall below the peritoneal fold with the greatest safety, without distending the bladder with fluid and without requiring it to be elevated by means of the Petersen rectal colpeurynter. This last expedient I never use any longer; a moderate filling of the bladder is of some advantage, on the other hand.

How easily and safely suprapubic lithotomy can be carried out in this way is best shown by the brevity of the time required. In the last sections for stone my assistants reckoned 35 to 50 seconds from the first incision in the skin to complete extraction of the stone.

The advantage of the elevated position of the pelvis is just as

striking in intraperitoneal operations in the pelvic cavity and in the lower abdominal sections.

For example, we take an intestinal resection by which an artificial anus in the femoral ring (after strangulation of a hernia) is to be removed. The patient is placed in the elevated pelvic position. Just above the fistula (imagining the patient in the standing position) a curved incision 10 cm. in length is made through the abdominal wall paralleling Poupart's ligament, the peritoneum is incised, air presses into the peritoneal cavity, all loops of intestine slip down to the diaphragm. The margins of the wound are spread with retractors and we now look into the emptied true pelvis, we view the whole iliac fossa and the single portion of intestine which presents itself is the loop adherent to the femoral ring. We can observe the relation of the two segments, can easily retract them with the fingers, draw them out, section and suture; none of the contents flows out because whatever fluid was present has flowed away toward the diaphragm. We work in the full light of the window above, like the artist at his easel, without needing to stoop, and, provided the narcosis is smooth, without being burdened by protruding loops of bowel.

The advantages of the elevated position of the pelvis are likewise of value in all gynecological operations in the pelvic cavity, and I believe that whoever has once removed a myomatous uterus or an adherent ovarian cyst in this way will not readily make up his mind to return to the old procedure. The tumor falls out of the pelvic cavity toward the operator as far as its connection in the pelvic cavity will permit, all connections which are to be separated are placed on the stretch, the blood flows away from the operative field, one need not trouble about the intestines as long as no vomiting occurs, they remain lying segregated in the "pit of the stomach" above, one sees what one is doing.

When the tumor is removed one is surprised by the free view of the whole of the true and false pelvis, the iliac and hypogastric vessels are seen pulsating, the ureter is observed running down, the small bleeding vessels are seen round about and they can be

transfixed and tied or ligated. Following the removal of the ovarian cyst, here lies the ligated pedicle, here the uterus and there the healthy ovary and its tube; previously the distorted pedicle could be demonstrated visually.

The elevated position of the pelvis is of great advantage in myomectomy, especially in difficult cases with intraligamentary extension of the tumor.

The operation is made so easy that panhysterectomy is done instead of supravaginal amputation.<sup>4</sup> One proceeds with the freeing of the growth, unmolested by loops of intestine, always doubly ligating, transfixing and cutting where he can see, down to the cervix, thrusts the bladder away from the uterus after making a transverse incision in the peritoneal reflection and thus lays bare the vaginal vault. The vagina has been disinfected previously and packed with iodoform gauze. The vaginal wall is now cut through obliquely against the ball of iodoform gauze, removing the entire tumor mass along with the uterus and portio, and the bleeding vessels of the vaginal wall are transfixed and ligated. Next the iodoform is drawn out of the vagina by way of the vulva and the vagina loosely filled with new iodoform gauze through the abdominal cavity, several strips of gauze reaching down posteriorly and laterally into the pockets under the peritoneum in which the ligamentary tumors were embedded. It is not sutured in the abdominal cavity. (4 operative cases.)

This procedure surpasses the usual supravaginal amputation of the uterus by virtue of its safety and simplicity. All steps of the operation can be carried out under visual control by the use of the elevated position of the pelvis, the blood loss is slight and the elastic ligation of the uterus therefore unnecessary. Likewise, the time consuming suturing of the stump of the uterus is abolished. Antiseptic closure and drainage of the abdominal

<sup>4</sup> Indeed Hofmeier found it very difficult to reach the cervix beneath the tumor in the case of a uterine myoma which had developed from the posterior surface of the cervix and spread between the vagina and peritoneum in the depths of the true pelvis, and finally carried out the separation not in the cervix, but in the upper portion of the vagina. Later Schröder successfully performed the operation in this manner in the case of a colossal tumor. Vergl. M. Hofmeier, *Grundriss der gynäkologischen Operationen*. p. 222.



cavity by means of the plug in the peritoneal opening proves to be just as satisfactory as in total vaginal extirpation of the uterus for carcinoma and as high extirpation of the rectum in rectal carcinoma. One need only avoid placing much iodoform in the abdominal cavity.

Perhaps the procedure of total extirpation of the myomatous uterus would be further perfected by the use of the Berthelot-Pean forceps after cutting the part away from the vagina.

Probably the elevated pelvic position could be used to advantage also in an operation which I undertook several years ago on a case of hydronephrosis, and which had for its purpose the correction of the cause of the formation of the hydronephrosis, namely, the abnormally high and valvelike insertion of the ureter into the kidney pelvis.

The abdominal cavity is opened by a longitudinal incision at the outer border of the rectus and the anterior wall of the large hydronephrotic tumor exposed. On the medial portion of the anterior wall the ureter is found easily, which, as Simon has determined already, is shoved upward by a continual anterior rotation of the distended kidney pelvis about its own axis. The cyst is punctured with the trocar at about a handbreath's distance from the ureter and emptied as far as possible. Thereupon the anterior wall is split downward from the same spot in order to free it, and the orifice of the ureter is sought for in the interior of the cyst thus opened. Then the ureter and the cyst wall are slit downward from the orifice throughout the entire extent of the tumor and the wound edges of the slit ureter firmly sutured to the wound edges of the cyst wall. Thus the opening is transferred to the lowest segment of the tumor. Finally the cyst is drained posteriorly toward the lumbar region, the first incision is sutured together again and the abdominal wound closed.

The case in which I performed this operation terminated fatally because of an ileus resulting from a kinking of the ascending colon which was adherent to the sac. The opportunity for further attempts has been lacking.

The elevated pelvic position has afforded me very good service also in exploration of a stab wound of the small bowel as well

as in the case of exploration and resection of a tuberculous stricture of the small bowel. In both cases it was previously determined with certainty that the affected loops of bowel lay in the lower portion of the abdominal cavity.

In laparotomies for internal incarceration, the elevated pelvic position is of less use because of the high positive pressure within the abdominal cavity.

On the other hand, it is an excellent means of rendering the interior of the vagina or the rectum accessible to the eye. Both cavities aspirate air and gape widely as soon as their entrance is held open by means of the fingers, a short speculum or some such means. In no other way can the interior of the rectum especially be exposed so expeditiously.

It can be demonstrated easily by means of a manometer that the pressure in the lower section of the abdominal cavity becomes negative with the elevated pelvic position. One need only connect it by means of a rubber tube to a catheter which has been introduced into the bladder. In the horizontal position of the body several trials showed a pressure of  $+1$ , with elevation of the pelvis a pressure of  $-6$  to  $-8$  to  $-11$  cm. of water.

From an historical aspect it is to be noted that the elevated pelvic position was used by the ancient surgeons in reduction of strangulated hernia. The incarcerated loop was supposed to be drawn out of the hernial aperture by the weight of the mesentery, attempts being made to further the reduction by vigorous shaking of the body. Thus Fabricius of Aquapendente ordered the patients hung up by the hands and feet, with the head downward and the pelvis higher than the thorax, the suspended patient being actively shaken. Corvillard had the patients hung up by the legs. According to Sharp, an assistant should take the patient on his back, the lower legs drawn over the shoulders, so that the popliteal spaces of the patient just rested upon the shoulders of the bearer. In this position he was shaken also. Ribes proceeded in a similar manner.<sup>5</sup> Freund<sup>6</sup> in the extirpation

<sup>5</sup> Bardeleben, Lehrbuch d. Chirurgie. 8 Aufl. III. p. 792.

<sup>6</sup> Freund, A New Method of Extirpation of the Uterus. Sammlung. klin. Vortr. v. Volkmann Nr. 133. p. 5.

of the carcinomatous uterus (1878) laid his patient "on a table so that her head, directed toward the window, lay lower than the pelvis.—After the abdomen was opened by means of an incision in the linea alba beginning three fingers-breadth below the umbilicus and extending close to the symphysis, the loops of bowel lying in the pelvis were pushed out and held away from the pelvic space by means of a moist hand towel introduced into the pouch of Douglas and tucked in above. This, along with the position of the woman described above, succeeded excellently for the purpose of the operation." This is all that has been said by Freund concerning the position in his extirpation of the uterus. Apparently the position of the patient corresponded only in a very incomplete way to what I designate as the elevated pelvic position; for by such marked raising of the pelvis as I use, it certainly would not have been necessary in the "emaciated" woman, to lift out and hold back the loops of bowel lying in the pelvis as they would fall down toward the diaphragm of themselves on the entrance of air and scarcely come into view. The operation took place in a "little proletarian room next to the kitchen", the table thus probably was not an operating table, but an ordinary kitchen table, on which a true elevated pelvic position probably could not be obtained without special supporting devices which are not mentioned by Freund. I do not know that Freund later developed the idea of the elevated pelvic position further in any other form or even described it clearly.—Also, in the textbooks nothing is said of the elevated pelvic position in discussion of Freund's operation.

At first I used the elevated pelvic position only in operations on the bladder for the purpose of making the interior of the bladder accessible to the daylight and to the eye after opening the bladder by a high lithotomy incision (1880). The matter had nothing to do with Freund's publication, I was much more influenced by the principle of the lateral abdominal position of Sims (1845), in which, as is known, the vulva forms the highest point of the torso and the opened vagina aspirates air and thus is made to gape as a result of the negative pressure in the pelvis.

I wished to fill the opened bladder with air in a like manner.<sup>7</sup> Not until later did the great advantage of the position for high lithotomy occur to me,<sup>8</sup> and to use it in laparotomies was the next very natural step. In every high lithotomy since 1884, in all laparotomies where operation concerned the pelvic cavity since the winter of 1887-1888, I have operated from the beginning in the elevated pelvic position only, and no semester has passed wherein I have not demonstrated one or the other type of operation.

De Leon<sup>9</sup> used the position in castration of women and recommended it also for gynecological examination, to make easy the palpation of the pelvic organs through the anterior abdominal wall, especially in tympany of the abdomen. Lange<sup>10</sup> recommended it for laparotomies in general and especially for hysterectomy. In Germany J. Veit<sup>11</sup> has become attached to it and expressed himself extensively on the advantages of the procedure. Previous to the last mentioned article, only Werth among the gynecologists, as far as I know, used the elevated pelvic position; other articles concerning it are to be expected.

There is not much to say concerning the technic of the elevated pelvic position. In the early years I had an attendant standing at the head end of the operating table, take the knees of the patient backwards over his shoulders, as the ancients did with their hernia patients; for some time I have used a special apparatus constructed by Eschbaum, which is placed at the head end of the operating table. Eschbaum exhibited it at the Cologne Scientific Congress (1888). The operation is not begun until anesthesia is complete and all straining and forced respiration has ceased. Also it is to be desired that during the operation, the anesthesia will remain complete, it is usually influenced in no way by the low position of the head. The thinner the indi-

<sup>7</sup> Vergl. bei W. Meyer l. c.

<sup>8</sup> Vergl. bei K. Eigenbrodt, High Lithotomy. Deutsche Ztschr. f. Chir. 1888. XXVIII. p. 72.

<sup>9</sup> de Leon. Centralbl. f. Gynakol. 1888. Nr. 21.

<sup>10</sup> F. Lange. New-Yorker med. Monatsschr. 1889. I. l. p. 1.

<sup>11</sup> J. Veit, The Technic of Laparotomy. Berliner Klinik. Heft 15. 1889.

vidual is and the emptier the intestine, the more the advantages of the position become apparent.

Now to return to lithotomy and to the operation for vesico-vaginal fistula!

If, with the pelvis elevated, the bladder is opened by means of a transverse incision 4 to 5 cm. in length parallel to the reflected fold of the peritoneum, and the split edges separated by means of blunt retractors or a bladder speculum, like those I have had fashioned from soft copper, then the bladder fills with air, if it is not filled with fluid, and after stopping the bleeding from the cut edges and removing the blood and the previously injected fluid by means of an irrigator which is used as a siphoning apparatus, the whole interior of the bladder becomes accessible to the eye. The region of the trigone lies opposite to the incision directly in the daylight; if a vesico-vaginal fistula is present, this meets the eye at once, anteriorly the internal ostium of the urethra is seen and the two orifices of the ureters on their folds of mucous membrane are recognized. If the light from the window is not bright enough then a concave mirror or an electric lamp is of aid (Vgl. bei Eigenbrodt).

The two accompanying photographs, taken of cadavers by Dr. Wendelstadt, illustrate what has been said; the body is suspended by the legs, the bladder has been exposed and opened transversely by a horizontal incision at the symphysis, the margins of the bladder wound have been sutured temporarily to the margins of the skin incision. In the male bladder the point of the catheter is seen protruding from the internal orifice of the urethra, the openings of both ureters, into which fine bougies have been inserted, are visible. In the female bladder, an opening has been cut in the vesico-vaginal septum to show the relations in vesico-vaginal fistula; the vagina is plugged with a sponge and the vesico-vaginal septum thus raised up into the bladder.

From the photographs it is clear without any further explanation, how easy it is to freshen up the margins of the vesico-vaginal fistula and to suture. In order to eliminate the bothersome retractors and specula and to avoid with surety any injury to the peritoneal fold in case of chance retching movements, the upper

margin of the bladder incision can be stitched to the upper margin of the transverse skin incision by a few temporary sutures, while the lower margin of the bladder incision is held away by retractors or by a suture drawn through to which a little weight has been fastened.

The freshening up is carried out in the usual way, in a funnel shape; if the fistula is located in the vicinity of one or the other orifices of the ureters, then a fine sound is passed into the ureter, in order to be certain that its opening is not included in the suture.

The sutures, of silk worm gut, are most easily tied in the bladder and cut short. However, there is then formed about them a light encrustation or a true bladder stone, and thus it is more fitting to lay the sutures so that they can be tied in the vagina.

For this purpose the sutures are fitted at both ends with long straight or slightly curved needles, the needles are thrust from the bladder through into the vagina and grasped here by the fingers of the left hand. The tying takes place in the vagina under control from the bladder. If it is desired to tie in the bladder, which, as has been said, is much easier, then one must not suture with silk or silkworm gut but with catgut, which is absorbed in the region of the needle wounds, so that the knots fall into the bladder and are expelled with the urine.

After the completed suturing of the fistula, it still remains to close the bladder walls by suture from both ends up to an opening for a drain in the middle. Torn places in the wound edges are smoothed out by means of the scissors, over the first line of sutures, which unites the margins of the wound as exactly as possible, a second layer of Lembert's sutures is laid, so that the bladder suture resembles the form of the intestinal suture. A T-shaped drainage tube is put in the drainage opening which has been left. Finally, the external wound is closed except for three drainage openings, in the middle drainage opening the bladder drain lies loosely, the prevesical space is drained especially through the two lateral openings by means of iodoform gauze.

The patient is now placed in the horizontal position and kept

suspended there until the bladder is thoroughly washed out through the T-tube with a weak bichloride solution, a narrow gauze tampon is placed in the vagina and the patient then put in bed on a water cushion in the lateral position so that the anterior abdominal wall appears slanting downward (lateral abdominal position). Several pillows support the back, the patient is turned from right to left and from left to right side every hour or every two hours in order to avoid pressure on the trochanter.

The wound is treated openly. A frequently changed moss cushion or a gauze compress catches the dripping urine; if the bladder drain should become plugged by a blood clot and the urine thus not drop freely from it, then the drainage tube is cautiously cleared by means of the stream of water from an irrigator, likewise if any cystitis is present or becomes noticeable in the next few days, the bladder must be irrigated cautiously through the drainage tube without great pressure. Otherwise the irrigation is superfluous and generally can be handled in a completely expectant manner.

From the 5th day on the patient can assume the supine position from time to time, on the 9th to 12th day the bladder drain is removed, and the wound then gradually heals by itself, from time to time extruding a few necrotic shreds of fascia. Soon the urinary pressure asserts itself, if this is satisfactory, a part of the urine passes through the urethra, part through the wound, the latter portion becomes less continually, and about twenty days after operation continence becomes complete. This is the course in the successful cure of vesico-vaginal fistula; if the suture sloughs out then all the urine naturally flows off through the vagina at once.

One objection which perhaps could be raised against my procedure requires some discussion. Thus, granted the complete safety of the high lithotomy with proper execution and management, the fear could arise, that the complete healing of the lithotomy wound might not occur and a fistula might be left above the symphysis. This fear is groundless if only the urine is kept from decomposing and an acid reaction maintained. In

over 50 cases of high lithotomy which I performed, only in a few cases did bladder fistulae result and, indeed, then only—in large carcinomata—when a severe cystitis existed, which rendered the urine alkaline, or when the voiding of the urine through the urethra remained continually hindered, as in patients with prostatic disease, who even before operation could void only with the aid of the catheter. In all other cases large incisions in the bladder with correspondingly large external incisions healed firmly without fistulae. The significance of the acid reaction of the urine for the healing of bladder fistulae has been demonstrated by Rosen already and attention must be paid to this point in the after-care. Washing out the bladder with lukewarm water, injections of silver nitrate in a solution of 1:1,000 to 1:500, and the internal use of camphoric acid (1 gr. several times daily) are especially effective in preventing and stopping decomposition of the urine. Above all, the camphoric acid is a priceless remedy.

The one disadvantage of the high lithotomy, especially with a transverse skin incision and detachment of the recti at the symphysis, consists of the possibility that later a small hernia may develop in the scar. However, doctor and patient should willingly compare the cost of this disadvantage to a persistent vesico-vaginal fistula.

I consider the drainage of the bladder during the first eight to fourteen days as an entirely necessary part of the whole procedure. During the first few days the suture of the fistula will keep entirely dry because of the divergence of the urine, bladder cramps are guarded against, all catheterization is avoided and, at the same time, in the bladder drain we have a means of irrigating the interior of the bladder whenever necessary and treating it with medication. All these advantages are not to be disregarded.

I do not regard it as suitable for the object in view to gain access to the bladder through a partial resection of the symphysis (Helferich and König<sup>12</sup>). One accomplishes nothing more than

<sup>12</sup> Vergl. *Verh. d. Deutsch. Gesellsch. f. Chir.* 1888. XVII. II. 116 ss. u. I. 100 ss.



by simple elevation of the pelvis, this is the key to the interior of the bladder.

As to what constitutes the indication. The transvesical method is to be recommended for high lying and concealed vesico-vaginal fistulae not accessible from the vagina, especially for fistulae in close proximity to the ureters, and further for all vesico-uterine fistulae, uretero-cervical fistulae and uretero-vaginal fistulae. The latter in all cases are more easily and more safely operated on from the bladder than from the vagina, the vesico-uterine fistulae offer no greater difficulty than the usual small vesico-vaginal fistulae when using the vesical approach, and the uretero-vaginal can be expected to be made accessible easily by slitting the ureter from within the bladder. Perhaps slitting of the mouth of the ureter alone will be sufficient to cause healing of the fistula to occur, just as the salivary fistula heals of itself without plastic closure if the saliva is conducted into the mouth by means of the procedure of Deguise.

Although I did not get results with my first two attempts at vesico-vaginal fistula repair from within the bladder and<sup>13</sup> finally had to resort to closure of the vagina, the cause lay in the unusual size of the defects and the fixation of their edges to the symphysis by scar tissue. The method, in itself, satisfied me completely and I decided to keep an eye open for suitable cases.

On July 1st of this year a 44 year old woman of Polish extraction, who suffered from dribbling of the urine from the vagina since delivery 15 years previously, came to me through the kindness of Dr. Zumwinkel in Laar near Ruhrort. The child had been the fifth and had been extracted with forceps. The examination revealed the following: In the anterior vaginal vault to the right of the midline an oval defect is found with the long axis from the right anteriorly to the left posteriorly, of about the size of a small plum stone, and through which the ball of the index finger may be inserted into the bladder. The right half of the portio is lacking, the rest distorted so that the entrance of the cervical canal is not to be found with the sound. The

<sup>13</sup> Vergl. bei Meyer l. c.

fundus of the uterus is directed to the right and posteriorly above. Because of cicatricial fixation it is not possible to bring down the uterus and the edges of the fistula.

Operation on July 2, 1888:

Anesthesia, elevated pelvic position with the aid of the Eschbaum apparatus. Transverse incision about 10 cm. long at the paper border of the symphysis. Separation of the recti from the symphysis, opening of the prevesical space. Introduction of a catheter into the bladder, transverse incision about 5-6 cm. in length in the anterior bladder wall below the peritoneal reflection. The upper margin of the bladder wound is sutured to the upper margin of the skin incision by several temporary sutures; several threads are drawn through the lower edge of the bladder incision, which, laden with several bolts hanging down, draw the wound margin down and to the side. At once the obliquely located defect of the vesico-vaginal septum is seen between the two ureteral orifices, lying closer to the right ureteral opening than to the left. At the upper edge of the fistula, which hangs inward with the remains of the portio, the uterine sound may be passed into the cervical canal in a direction upward, posteriorly and to the left.—

The sharp edges of the fistula are now freshened up in a funnel shaped manner, so that a broad strip is removed from the mucous membrane of the bladder, while from the mucosa of the vagina and cervix only a narrow border is taken, this freshened surface in the bladder has a breadth of 1 cm. on the left; on the right, because of the proximity of the ureteral orifice, it can be only 5-6 mm. in breadth.—Next, six sutures of silkworm gut are laid by means of the usual curved needles and an ordinary needle holder, the one small difficulty here being to locate the orifice of the ureter lying close to the freshened area and avoid it carefully while suturing. On this account it is marked by introducing a fine sound. The tying of the sutures in the bladder is carried out as conveniently as in an ordinary skin incision on the body surface. After finishing the suturing the entrance of the cervical canal lies in the vagina.

Finally the temporary sutures in the upper margin of the

bladder are divided and the two margins of the bladder incision united by means of simple sutures and Lembert sutures from each side toward the middle. In the middle a small opening is left into which the T-shaped bladder drain is inserted. Washing out of the bladder with bichloride solution 1:5,000 in the abdominal position. Closure of the skin incision except for the central drainage opening and the two lateral ones.

Placing in the lateral abdominal position. Post operative course almost without reaction, highest temperature 38.4 on the 4th day.—Urine slightly turbid. Washing out, camphoric acid internally.—Removal of the bladder drain on the 16th day. No further urine from the lithotomy wound from the 21st day on. Urine can be held for  $\frac{1}{2}$  hour.—4 weeks after operation: urine can be held for 1 hour.—7 weeks after operation: wound closed. Urine held for 2–3 hours.—

Following her discharge from the clinic a new trouble arose; the pressure of urine became more frequent and painful bladder cramps set in. At examination on September 17, Dr. Zumwinkel found concretions in the bladder, and therefore dilated the urethra under anesthesia on September 21 and extracted several concretions of over pea size located on the posterior bladder wall. These had to be torn away from the bladder wall with the fingers, the threads of silkworm gut, with which the fistula had been closed, came away with them. One very firmly situated suture could not be removed. Several smaller concretions were located on the anterior wall of the bladder.

However, the fistula is closed and the continence remains lasting.

This last incident shows that the fistula suture should not be tied in the bladder, when using a non-absorbable suture, as I had been led to do by the greater ease of the procedure, but rather tied in the vagina, as I had done in my first two cases. Also the bladder suture in the region of the lithotomy wound must be so sutured that no thread end projects into the bladder if one does not wish to sew with catgut here also—which is the most advantageous.<sup>14</sup>

<sup>14</sup> In the meantime, I have used the method described with the suture knots in the vagina in another case with complete success.

## 2.

The closure of a vesico-vaginal fistula by transplantation of a flap is no entirely new procedure. Operations of this sort were carried out by Joubert, Roux, Wutzer and others, or, better said, attempts at operation were undertaken. For an entirely sure case of cure of a vesico-vaginal fistula by transplantation of a flap is not to be found in the old literature.

Jobert cut an oval shaped piece of skin from the labium majorum, folded it with the raw surface outermost throughout its length and used it as an organic plug in the pathological fistula. Threads, which were lead out through the urethra, were to hold the plug in the fistula. The plugs would not heal in. A similar attempt with a skin flap taken from the gluteal fold is said to have been successful.<sup>15</sup> Velpeau recommended separating the mucosa of the vagina in the form of a bridge and displacing it over the fistula. Wutzer<sup>16</sup> sutured a flap 3 inches long by 2 inches wide with a pedicle 2 inches long taken from the inner surface of the thigh, into a large defect of the vesico-vaginal septum, the pedicle was sutured into an incision between the labia majorum and minorum, the flap became necrotic. Previously Wutzer, with the same patient, had made an attempt to close the vagina below the fistula with a pedunculated flap taken from the posterior vaginal wall, which likewise did not succeed. Szmanski<sup>17</sup> mentions the same case in such a manner that the reader believes that Wutzer has transplanted this flap from the posterior vaginal wall into the defect itself, which, however, was not the case, it was an attempt at closure of the vagina.

Dieffenbach declared all attempts at closing the fistulae by means of flaps taken from the external skin to be irrational and returned to the old method of freshening up and suturing first advocated by Roonhuysen (1663). Since then the attempts at transplanation have almost fallen into oblivion and their proud name, elytrorplastic, is forgotten. Winckel does not mention it at all in his monograph.

<sup>15</sup> Zeis. Hand buch der plast. Chir. 1838. p. 532 ss.

<sup>16</sup> C. W. Wurtzer, On the Cure of Vesico-vaginal Fistula with the Aid of Puncture of the Bladder. Organ f. d. gesammte Heilkunde. II. 4. 122. 1843.

<sup>17</sup> v. Szymanowski, Handbuch. d. operativen Chirurgie. I., p. 375.

In more recent times Fritsch<sup>18</sup> has replaced the lower wall of the urethra with a flap taken from the labium minorum with good results. Rydgier,<sup>19</sup> in a case with an extensive defect of the vesico-vaginal septum, developed the plan of replacing the defect with a flap taken from the posterior wall of the vagina. For the purpose of obtaining a pedicle for the flap, the anterior vaginal wall was first joined to the posterior at the lower border of the fistula, later the flap was to be cut from the posterior wall above this spot and opposite to the defect. However, the patient was so satisfied with the transverse obliteration of the vagina which was the result of the first step of the operation, that she did not appear again, and therefore the plan of operation was not carried out. Also it probably would have been difficult to carry it to completion, for how could space be found above the transverse obliteration, without separating this entirely again, to dissect out the correct plastic flap from the posterior wall?

At the conclusion of this case Rydgier makes a second proposal for similar cases. A tongue shaped flap, taken from the posterior vaginal wall with the under side freed, and displaced forward with the mucosal side toward the bladder would be sutured into the upper part of the defect. In a second operative step the transverse obliteration of the fistula would be carried out at the lower margin of the fistula, not through the whole width of the vagina but only corresponding to the breadth of the fistula. Finally, the posterior vaginal wall would be cut across below the site of obliteration, the flap would be entirely freed from the underlying structures and with its lateral portions, would grow into the lower part of the fistula. The reattachment of the freed flap to the posterior vaginal wall would be prevented by inserting strips of iodoform gauze.

It appears to me as very doubtful whether it would be possible

<sup>18</sup> Fritsch. *Centralbl. f. Gynakol.* 1887. Nr. 30.—The operations mentioned in *Centralbl. f. Gyn.* 1888. Nr. 49 do not belong here, for the "flap formation" here concerned only a distortion of the undermined edges and not a true flap transplant.

<sup>19</sup> *Berl. klin. Wochenschr.* 1887. Nr. 31. Following a lecture to students of natural science. Berlin 1886.

to close a defect so large as to include the portio vaginalis by the method described by Rydgier. Even with the first step it would be very difficult technically to suture the upper margin of the flap to the upper margin of the fistula so exactly that healing by primary intention could be expected.

In that case I would propose the high lithotomy with wide opening of the bladder in order to be able to freshen up the margins of the fistula with the remainder of the portio exactly and suture it carefully to the margins of the flap. The dissecting out of the flap naturally would have to take place from the vagina. From the bladder the flap, likewise in the first step of operation, would be sutured not only above, but also to the sides, thus leaving only the freeing of the flap and the suturing of its pedicle into the lower margin of the fistula from the vagina as the second step (without any previous obliteration of the vagina). If then the suture line were kept dry for some time longer by drainage of the bladder, healing perhaps could be expected.

But not much is won by such proposals, the result of experience alone decides.

In smaller defects which do not extend so far above, the conditions are more favorable for grafting. One is then not limited to the thin scarred margin of the fistula for embedding the graft, in that the region about the fistula is freshened up in a broad ring and the whole now covered with a correspondingly large flap, with the raw surface turned toward the bladder and spread over the raw surface lying about the fistula on all sides in the shape of a ring.

In other fistulae difficult to remove, especially in urethral fistulae in men, either in the perineum or in the penis, I have showed this procedure of covering the fistula with a pedicle graft from the vicinity to be very serviceable.

The entire region about the fistula is denuded for a width of at least 1 cm. round about, and the pedunculated tongue shaped graft from the neighboring skin—thus from the scrotum, from the inguinal region, or from the thigh—is made large enough to fit exactly into the circular wound surface after contraction. A spur is left between the denuded area and the secondary de-

fect made by taking the graft as in Langenbeck's cheiloplasty; the spur is raised up over the defect, fitted into the defect and its margin fastened to the margin of the denuded area preserving the spur. The margin of the fistula is likewise freshened; for the rest, one does not need to trouble about it. In earlier times Cooper, Philipps, and Delpech have used similar operations for the cure of urinary fistulae in men.<sup>20</sup>

According to the analogy with this procedure in urinary fistula in the penis or perineum, one must take the graft in vesico-vaginal fistulae from the anterior wall of the vagina. In very small fistulae—which, however, almost always are cured by Simon's method—this would be possible. In somewhat larger fistulae it would be difficult to obtain a sufficiently large graft from the anterior vaginal wall after sufficiently large denudation in this region. On the other hand, the whole posterior wall is at our disposal in a most convenient way.

To be sure, if we use it, we must abandon the Indian method—transplantation of neighboring skin—and go over to the method of Tagliacozzi, but we have the most favorable conditions possible for the carrying out of this method. The posterior vaginal wall lies on the anterior vaginal wall of itself, so we need not bring one part of the body to another and fasten it artificially as in rhinoplasty; we take a horseshoe shaped flap with a lower broad pedicle from the posterior vaginal wall and fold it down so that its raw surface faces anteriorly, thus, wholly of itself, it lies with its raw surface against the denuded area on the anterior vaginal wall, and, with its free edges sutured to the lower and lateral edges of the denuded area, heals easily. Later the bridge must be cut through and the lower part of the graft thus entirely freed must be fastened to the upper part of the defect and its vicinity after freshening up. The whole flap from the posterior vaginal wall thus has been transferred to the anterior vaginal wall, its mucosal surface, as before, faces into the vagina, and its upper margin has come down, its lower margin up.

On March 21, 1887, I carried out this plan of operation on a vesico-vaginal fistula, which had been operated upon by Simon's

<sup>20</sup> Czerny, Arch. f. klin. Chir. XXI. 1. p. 65 ss.

method seven times without results, partly by myself and partly by others.<sup>21</sup>

The fistula, just passable by the ball of the index finger, lay in the lowest segment of the bladder, close to the internal orifice of the urethra, and thus in a location where vesico-vaginal fistulae are very easy to expose but difficult to close.<sup>22</sup> The margins were indurated by scar tissue as a result of the earlier unsuccessful operations. In these operations the unusually marked irritability of the bladder along with the tension of the suturing had proved to be a real obstacle to healing; every time the woman had suffered ceaseless desire to urinate and painful bladder spasms, so that she had to be catheterized very often, nor could she tolerate an indwelling catheter.

The first step of the operation consisted only in denuding the area about the fistula, including the margin of the fistula, for a good 1 cm. in breadth, but only below (anteriorly) and toward the sides, while the upper margin and its surrounding region were left untouched. The shape of the denuded surface together with the fistula thus corresponded approximately to the area of a semi-circle with a radius from  $1\frac{1}{2}$  to 2 cm. Next the Simon's posterior speculum was drawn out of the vagina far enough to allow the posterior vaginal wall to lay against the denuded area on the anterior vaginal wall and a mark was made with the knife at the place on the posterior vaginal wall which touched the lowest point of the denuded area. Now an anterior speculum was introduced and a horseshoe shaped flap about 4 cm. wide by 4-5 cm. long with a lower pedicle 4 cm. long was dissected out of the posterior vaginal wall so that the bleeding mark previously mentioned lay below the middle of the pedicle. The flap was cautiously freed and turned all the way down so that its pedicle formed a transverse fold and the raw surface of the flap faced anteriorly. The bleeding defect of the posterior vaginal wall, resulting from this, was partly closed again by sutures from above downward. Now the formerly upper but now lower

<sup>21</sup> Vergl. Correspondenzbl. d. arztl. Verein in Rhineland u. Westphal. 1887. Sept.

<sup>22</sup> G. Simon, Operations for Vesico-vaginal Fistula. Wien. medic. Wochenschr. 1876. Nr. 27 ss.



margin of the graft could be sutured to the lower margin of the denuded area with ease, as were the lateral edges with the lateral borders of the denuded area. On either side next to the pedicle which was not sutured, an opening remained free for the passage of the urine and menses. Here strips of iodoform gauze were introduced loosely.

Primary healing occurred throughout the region of the whole suture line, and furthermore, the flap healed to the surface so far that a portion of the fistula was covered.

Four weeks later the pedicle of the graft was cut about with an incision, which was sharply convex downward, and separated from the posterior wall. Thus the graft now sat upon the lower part of the fistula and its surrounding region like the Tagliacozzi nasal graft on the root of the nose after separation of the flap from the arm. Its free edge could be drawn away easily with retractors far enough to expose the rest of the fistula and the partly scarred, partly granulating raw surface of the flap. Thus it was possible to freshen up the old raw area of the graft and the as yet uncovered region about the upper margin of the fistula without difficulty by means of the knife and scissors, the freed graft lay with its bleeding surface against the bleeding surface of the anterior vaginal wall and was sutured into it. Thus it was "stood on its head" and transferred entirely from the posterior to the anterior vaginal wall.

In order to avoid infiltration of urine under the flap and any irritation of the bladder by catheterization, the bladder was finally opened above the symphysis in the elevated pelvic position and a drainage tube introduced into the small opening. In bed, the patient was placed in the lateral abdominal position.

The course of healing was entirely undisturbed, the urine dropped away through the lithotomy wound as long as the drainage tube was in place (about 10 days), meanwhile the graft healed completely and after closure of the lithotomy wound the patient enjoyed complete continence.

Since that time she has passed through two deliveries happily. A little hernia developed in the scar above the symphysis and the woman wears a truss for this.

Of most importance for the completion of healing in this case

was the drainage of the bladder above the symphysis by means of which the field of operation was kept dry and relatively aseptic.

In a longitudinally closed fistula the filling of the bladder with urine is known to be no obstacle to healing by primary intention, since in a well closed suture the urine generally can not penetrate the fissure of the wound. On the other hand, where we are concerned with the taking of a graft on a large wound surface in the region about a fistula, it is a different matter. The urine, mixed with wound secretion, would run down into the vagina through the open fistula between the raw surface of the graft and the denuded area and probably cause suppuration in the healing of the graft. Healing by primary intention is to be expected only when the wound is kept dry.

Wutzer already sought to attain such an end when he thrust a curved trochar from the bladder through the anterior bladder wall and abdominal wall close to the symphysis in the midline, and drew the cannula of the trochar far enough out in the canal that its one end lay in the bladder and its other stuck out above the symphysis. His patients therefore had to remain lying on the abdomen, buckled up motionless on a special apparatus, and the silver cannula was held immovable in the bladder by means of a tube holder incorporated in the apparatus. This was naturally a very distressing, wholly unsure, and, according to our present day concept, unsafe procedure. But one must consider that there were no rubber drains at that time! The progress of technic, as so often, had first to place the proper means in the hands of the proper mind before it could be made useful.

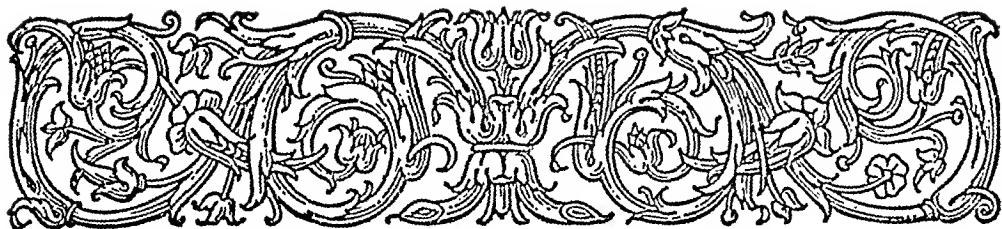
A T-shaped rubber drain hanging freely in the bladder, such as we now use, irritates the patient in no way, also the lateral abdominal position (naturally without any fastening) is not too great a burden, and it is a great advantage for the undisturbed healing of the wound and a great comfort to the patient if all catheterization can be made unnecessary. In case of severe irritability of the bladder, such as was present in our patient, the drainage of the bladder by Simon's method is therefore to be recommended.

If the indications for the method of transplantation of a flap

from the posterior vaginal wall are asked, no wholly definite answer can be given. It is to be recommended for vesico-vaginal fistulae which are not too large and not located too high, in these Simon's method will not attain its end because of the great tension on the suture; especially for operation following a partially successful Simon's operation, in order to close the remaining disagreeable, thin edged fistulae surrounded by rigid scars, which, it is known, often obstinately withstand closure by direct union even after Bozeman's preliminary treatment.

Both methods, the transvesical method and the transplantation procedures, will, I hope, bring it about that closure of the vagina, closure of the uterus and extirpation of kidneys will become more and more rarely necessary in urinary fistulae.

THE END



# Ueber die Unterbindung der Vena saphena magna bei Unterschenkelvaricen

VON  
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**D**IE Fälle von Unterschenkelvaricen im Bereich der Vena saphena magna lassen sich in zwei gesonderte Gruppen einteilen. Es gibt Fälle, in denen die varicöse Entartung auf die Aeste der V. saphena magna beschränkt ist, während der Stamm keine wesentliche Veränderung erkennen lässt, und andererseits solche, in denen der Stamm der Saphena ebenfalls stark erweitert und varicös entartet ist. Nur die letztbezeichnete Gruppe, die Fälle von gleichzeitiger varicöser Erweiterung der Aeste und des Stammes der Saphena sollen in der folgenden Auseinandersetzung Berücksichtigung finden.

Bei Männern findet sich dieser höhere Grad des Leidens häufiger als bei Frauen. Die erste Spur der Veränderung zeigt sich oft schon zur Zeit der Pubertät und die Anamnese lässt auf eine hereditäre Anlage zu Venenerweiterung schliessen; mitunter finden sich neben den Unterschenkelvaricen Hämorrhoiden oder eine Varicocele. Bei Frauen spielen in ätiologischer Beziehung wiederholte Schwangerschaften eine wichtige Rolle.

(S. 196) Die Beteiligung des Stammes der Saphena magna fällt bei der Betrachtung des entblösten Beines im Stehen sofort

in die Augen. Man sieht an der inneren Seite des Kniegelenks hinter dem *Condylus internus femoris* und weiter nach oben an der inneren Seite des Oberschenkels im Bereiche seines unteren Drittels die Vene als kleinfinger- bis daumendicken leicht geschlängelten Strang in die Höhe ziehen, die verdünnte Haut hervorwölbind. An der Grenze des unteren und mittleren Drittels zeigt sich gewöhnlich ein besonders stark prominierender, etwa haselnuss- bis wallnussgrosser *circumskripter Varix*, ein zweiter noch grösserer lässt sich oft weiter oben dicht vor dem Eintritt der Vene in die *Fossa ovalis* erkennen. Er bildet eine flachere Hervorwölbung als der erste, weil er von einer dickeren Fettschicht bedeckt ist. Im ganzen Bereich der zwei oberen Drittel des Oberschenkels ist überhaupt die erweiterte *Saphena* ausser bei sehr mageren Individuen weniger deutlich zu sehen als im unteren Drittel. Unterhalb des Kniegelenks geht der erweiterte Stamm der *Saphena* in das unregelmässig geformte, beim Stehen prall gespannte und durch die verdünnte Haut bläulich durchschimmernde Konvolut von stark geschlängelten und erweiterten Aesten über.

Jene beiden *circumskripten Varicen* des Stammes entsprechen den Stellen von Klappen in der Vene, wie denn bekanntlich überhaupt bei *varicöser Entartung* von Venen die Stellen, wo Klappen liegen, immer am stärksten an der Veränderung beteiligt sind. *Exstirpiert* man einen solchen *circumskripten Varix* der *Saphena*, so findet man an der Wand die beiden Hälften der Klappen entweder noch unverändert oder teilweise verödet und zu seitlichen Leisten eingeschrumpft. Der grösste Durchmesser der Erweiterung liegt aber nicht oberhalb der Klappe, wie man glauben sollte, sondern vielmehr unterhalb derselben, nicht centralwärts, sondern peripher, eine Thatsache, welche bisher, wie es scheint, nicht beachtet worden ist. Augenscheinlich ist dicht unterhalb der Klappe die Venenwand am schwächsten, da sie ja auch bei normalen Verhältnissen hier den geringsten Druck auszuhalten hat. Wird die Klappe durch Erweiterung der Vene *insufficient*, und kommt die Venenwand damit unter den abnorm starken Druck einer längeren Blutsäule, so wird diese Stelle dem Druck am leichtesten nachgeben, also hier sich ein *circumskripter*

Varix entwickeln. Weshalb von den zahlreichen Stellen, an denen sich Klappen in der Vena saphen finden, (S. 197) (Klotz<sup>1</sup> fand deren 8–18), grade jene Stelle an der Grenze des mittleren und unteren Drittels des Oberschenkels und die Stelle dicht vor dem Eintritt der Saphena in die Femoralis mit Vorliebe der Sitz eines grösseren cirkumskripten Varix wird, lässt sich aus dem, was über die Anatomie der Saphena bis jetzt bekannt ist, wohl nicht erklären.

Was den Fällen von Unterschenkelvaricen mit gleichzeitiger Erweiterung des Stammes der Saphena nun ihre besondere Bedeutung verleiht, ist die Insufficienz der Klappen des Saphenastammes, welche schon bei verhältnismässig geringfügiger Erweiterung des Venenlumens zu Stande kommt. Die Vena cava, die V. iliaca und der Stamm der V. femoralis dicht unterhalb des Poupart'schen Bandes haben bekanntlich in der Regel überhaupt keine Klappen.<sup>2</sup> Sobald also die Klappen des Stammes der Saphena insufficient geworden sind, findet kein Klappenverschluss mehr statt von den Unterschenkelvaricen aufwärts bis zum rechten Herzen. Die Vena cava, Vena iliaca, der oberste Teil der Femoralis und die Saphena mit ihren Aesten bilden ein einziges weites, durch keinen Ventilverschluss unterbrochenes kommunizierendes Rohrsystem, dessen flüssiger Inhalt in seinen Bewegungen im wesentlichen nur der Schwere folgt.

Es lässt sich dies in folgender Weise leicht demonstrieren: legt der Kranke sich horizontal nieder, so werden die Unterschenkelvaricen bekanntlich sofort kleiner und weniger prall gespannt, sie bleiben indessen mässig gefüllt, solange sie sich unter dem Niveau des Herzens befinden. Erhebt man dagegen das Bein vom Lager, so entleeren sie sich um so mehr, je höher der Unterschenkel über das Niveau des Herzens gehoben wird. Bei Erhebung desselben bis zur Senkrechten fliesst sämtliches Blut mit grosser Schnelligkeit ab und der Luftdruck presst die verdünnte Haut auf den Varicen mit der dünnen Varicenwand in das Venenlumen hinein. Wo beim stehenden Kranken das Konvolut dicker geschlängelter

<sup>1</sup> K. Klotz (Braune). Untersuchungen über die Vena saphena magna. Archiv für Anatomie und Physiologie. 1887. 159 ff.

<sup>2</sup> Ueber Ausnahmen vgl. bei Friedreich. Morphol. Jahrb. III. 323.

Wülste prominierte, da sehen wir jetzt ein in der Form genau entsprechendes System von Gruben und Rinnen, ausgetrockneten Flussbetten vergleichbar.

Bringt man nun bei noch erhobenem Bein den Oberkörper in die halbsitzende Stellung, so dass Herz und Vena cava superior in (S. 198) ein höheres Niveau kommen, so füllt sich die Saphena teilweise wieder mit Blut. Bei mageren Individuen kann man deutlich sehen und fühlen, wie der Flüssigkeitsspiegel etwa dem Niveau des Herzens entspricht. Er steigt, wenn der Oberkörper noch mehr in die Höhe gerichtet wird, und sinkt, wenn er herabgelassen wird. Vena cava, iliaca und saphena verhalten sich also wie ein kommunizierendes Röhrensystem im physikalischen Sinne.

Neben der Schwere wirkt bei diesem Versuch natürlich auch der Druck in der Bauchhöhle auf die Blutsäule in der Saphena. Verschiessen wir bei kommunizierenden Glasröhren den einen Schenkel mit einer dünnen Gummiplatte und drücken nun mit dem Finger auf die Platte, so steigt die Flüssigkeitssäule in dem anderen Schenkel. Ebenso steigt die Blutsäule in der Saphena, sobald der Kranke in der beschriebenen Lagerung hustet, presst oder kräftig inspiriert. Lässt man dabei das Bein soweit heruntersinken, dass der Unterschenkel nur wenig über dem Niveau des Herzens liegt, so sieht man beim Hustenstoss eine flache Blutwelle durch die Saphena und ihre Aeste hinlaufen und wieder abfließen. Die erweiterte Saphena bildet also bei liegendem Kranken gewissermassen ein an die Bauchhöhle angesetztes Manometer. Dasselbe ist so empfindlich, dass sogar das Anklopfen mit dem Finger gegen die Bauchwand durch eine kleine Schwankung des Flüssigkeitsniveaus in der Saphena beantwortet wird.

Steht der Kranke nun vom Lager auf, so ist das ganze Kanalsystem sofort wieder prall mit Blut gefüllt, so schnell, dass es sich nur um ein Zurückströmen des Blutes aus der Vena iliaca, nicht um eine Füllung durch Zufluss von den Kapillaren her handeln kann.

Ein sehr einfaches Experiment beweist die Richtigkeit dieser Anschauung. Man legt den Kranken wieder flach hin, erhebt das

Bein bis zur Senkrechten, lässt alles Blut aus dem Gebiet der Saphena abfliessen und komprimiert nun den Stamm der Saphena an einer Stelle, wo er deutlich zu erkennen ist, mit dem Finger. Nun lässt man den Kranken, ohne dass der komprimierende Finger die Saphena verlässt, vorsichtig vom Lager heruntersteigen. Es zeigt sich, dass das ganze Stromgebiet der Saphena jetzt auch im Stehen zunächst ganz leer bleibt. Erst nach Ablauf etwa einer viertelbis halben Minute sieht man, wie die Varicen am Unterschenkel sich allmählich wieder mit Blut zu füllen anfangen. Die Füllung wird aber, so lange die Kompression des Stammes andauert, nicht annähernd so prall als sie es vorher gewesen. Erst wenn man den (S. 199) komprimierenden Finger weg zieht, schiesst eine grössere Menge Blut von oben her in die Saphena ein und das alte Bild der prall gespannten Varicen ist wieder da.

Das Blut, welches unter gewöhnlichen Verhältnissen das Gebiet der varicösen Saphena füllt, stammt also nur zum kleineren Teil aus den Kapillaren, zum grösseren Teil ist es aus der Vena iliaca zurückgeflossen. Der erweiterte Stamm der Saphena verhält sich wie ein toter Flussarm im Stromdelta, dessen Füllung mehr von Ebbe und Flut der See abhängig ist, als von dem Strömen des Flusswassers.

Die Blutmenge, welche von der Iliaca her in die Saphena abfliesst, wenn der Kranke die horizontale Lage mit der senkrechten Stellung vertauscht, ist bei starker Erweiterung der Saphena und ihrer Aeste eine sehr beträchtliche. Ich habe es früher versucht, die Quantität zu messen, indem ich den Kranken das Bein bei komprimierter Saphena in ein hohes, cylindrisches Gefäss mit Wasser stellen liess, und nun die Wassermenge maass, welche überfloss, nachdem die Kompression aufgehört hatte. Die Versuche stiessen auf technische Schwierigkeiten und ergaben keine genauen Resultate. Doch liess sich die Menge des zurückfliessenden Blutes auf 200–250 gr schätzen.

Das Zurückfliessen des Blutes aus der Vena iliaca und cava macht ja auch die Blutungen aus geplatzten Varicen bei erweiterter Saphena so profus und gefährlich. Schon aus einer kaum stecknadelkopfgrossen Oeffnung spritzt das Blut infolge



des Druckes der hohen Blutsäule in deutlichem Strahle heraus, und wenn ein etwas grösserer Varix platzt, ist die Blutung so profus wie aus einer grossen Arterie. Wiederholt sah man in wenigen Momenten den Tod durch Verblutung eintreten. Die das Blut austreibende Kraft ist lediglich die Schwere und wenn der Kranke daher sofort ohnmächtig umfällt, oder wenn er den richtigen Instinkt oder die Geistesgegenwart hat, sich sofort horizontal niederzulegen, so muss die Blutung stehen.

Aber nicht nur die Varicen der grösseren Venenäste, auch die kleinsten kaum sichtbaren Hautvenen am Unterschenkel, am inneren Knöchel und am Fussrücken stehen, soweit sie zum Stromgebiet der Saphena gehören, unter dem Einfluss des abnorm hohen Blutdruckes. Auch sie werden nur zum Teil auf normalem Wege von den Kapillaren her gespeist; ihre pralle Füllung hängt ebenso wie die Füllung der grösseren Varicen von dem Rückströmen des Blutes von oben her ab. Beweisend ist wieder das oben erwähnte (S. 200) Experiment, man achte dabei auf die feine geäderte Zeichnung blauer und karmoisinfarbener kleinster ektatischer Hautvenen, wie sie sich beim Stehen am Unterschenkel, in der inneren Knöchelgegend und am Fussrücken findet. Man lege den Kranken mit erhobenem Beine flach hin, komprimiere die Saphena und lasse ihn wieder aufstehen. Solange die Kompression dauert, sind die feinen geschlängelten Linien fast verschwunden, sobald sie nachlässt, schießt die Zeichnung wieder hervor; solange die Kompression dauert, bleibt die Haut ziemlich blass, sobald die Kompression aufhört, nimmt sie ihre gewöhnliche livide Farbe wieder an.

Ein abnormer Druck in den kleinsten Venen wird weiterhin die Cirkulation in dem Kapillarnetz sehr wesentlich stören müssen. Es ist daher verständlich, dass nicht nur bei längerem Stehen Oedem auftritt, sondern auch allmählich eine Ernährungsstörung der Haut sich ausbildet, welche es verhindert, dass bei kleinen Verletzungen die Heilung in prompter Weise erfolgt, und welche bei mangelndem Schutz gegen lokale Sepsis aus der unbedeutenden kleinen Erosion ein sich selbständig vergrösserndes Ulcus entstehen lässt. Die Heilung eines solchen Ulcus kommt bekanntlich nur schwer zu stande, solange der Kranke

sich nicht in das Bett legt und auf diese Weise die Gewebe von dem Druck der Blutsäule entlastet. Auch bricht die Narbe leicht wieder auf, und es sind keineswegs immer Verletzungen der Narbe durch Stoss, welche das Wiederaufbrechen veranlassen, dasselbe kann auch spontan erfolgen.

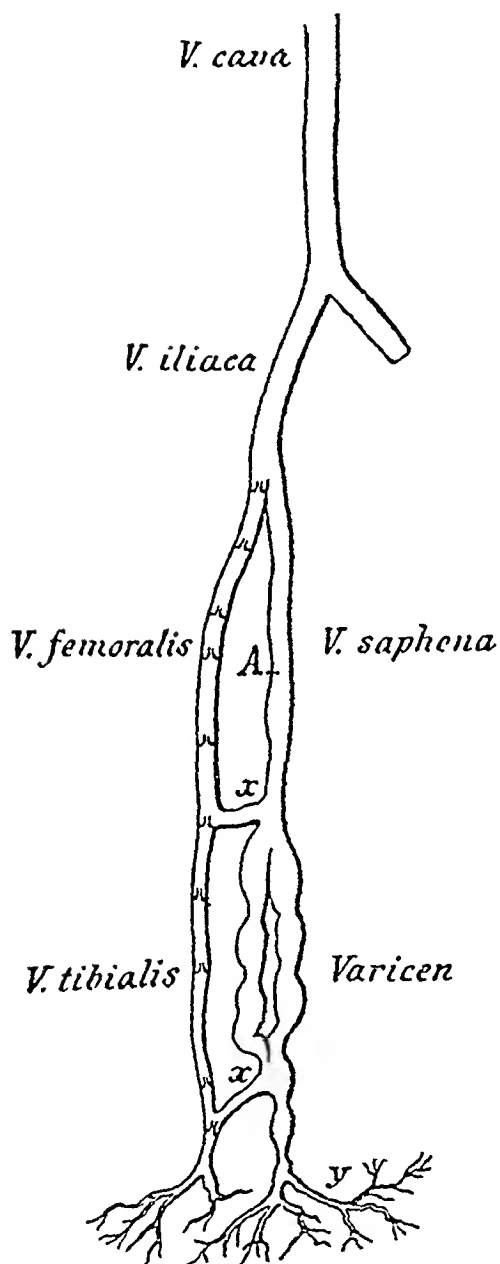
Hat man in solchen Fällen Gelegenheit, die Narbe in der letzten Zeit vor dem Wiederaufbrechen zu beobachten, so sieht man wie die erste Störung in einer Blutung in das Narbengewebe besteht. Bei einer stärkeren Körperanstrengung, welche den Druck in den Venen erhöht, empfindet der Kranke einen leichten Schmerz in der Narbe, und es zeigt sich in der äusserlich noch intakten Narbe eine blauschwarze *Sugillation*, die Stelle bleibt etwas empfindlich, das deckende Epithel stösst sich nach einigen Tagen oder Wochen ab, und eine blutig seröse Flüssigkeit wird secerniert, welche krümmelige Reste des eingetrockneten Blutextravasates enthält. Unter günstigen Umständen bildet sich dann ein trockener Schorf, unter dem sich der Substanzverlust ganz allmählich wieder ersetzt, bei mangelnder Antisepsis siedeln sich pyogene Kokken an, es entsteht eine entzündliche Infiltration der Umgebung, und das Ulcus ist wieder da.

Wenn somit die einfache Thatsache, dass die varicösen Aeste (S. 201) der Saphena infolge gleichzeitiger Erweiterung des Stammes durch keinen Klappenverschluss von der Vena cava getrennt sind, einen grossen Teil der Beschwerden und Gefahren bedingt, denen an Unterschenkelvaricen Leidende ausgesetzt sind, so liegt der Gedanke nahe, auf operativem Wege durch dauernden Verschluss der Saphena an einer Stelle das Blut an dem Zurückfliessen von der Vena iliaca durch die Saphena in die Varicen zu verhindern und zugleich die Venen des Unterschenkels und Fusses von dem abnormen Drucke zu befreien, der auf ihnen lastet. Ein solcher dauernder Verschluss ist durch doppelte Unterbindung und Durchschneidung der Vene zwischen den Ligaturen leicht und ohne Gefahr zu erzielen, und nachdem ich diese Operation seit dem Jahre 1880 in einer grösseren Reihe von Fällen mit bestem Erfolge angewandt habe, kann ich dieselbe für alle Fälle von Unterschenkelvaricen mit gleichzeitiger Erweiterung der Saphena empfehlen.

Wer sich die hydrostatischen Verhältnisse noch nicht in der geschilderten Weise klar gemacht hat, wer nur an die erste Entstehung der Varicen in manchen Fällen durch Kompression der Vena iliaca denkt (Gravidität etc.), dem wird es zunächst befremdlich erscheinen, die Stauung durch Unterbindung des abführenden Kanales beseitigen zu wollen. Aber es ist zu bedenken, dass es sich eben nicht um eine Unterbindung der Vena iliaca femoralis handelt, sondern um die Unterbindung der Saphena magna, welche nicht der einzige abführende Kanal aus dem Stromgebiete der Aeste der Saphena ist. Es bestehen Kommunikationen einerseits mit den tiefen Venenbahnen, andererseits mit der Saphena parva sowohl durch den Arcus dorsalis als auch oft durch direkte Kommunikationen. Nach den Untersuchungen von Klotz und Anderen haben diese Verbindungsvenen zum Teil Klappen, und wenn auch nicht die Ventile alle so gestellt sind, dass sie das Blut aus der Saphena in die anderen Stämme abführen, wie Luschka glaubte, so findet dieses Verhältnis doch sicher in einem Teil der Verbindungsvenen statt, und bei verschlossenem Stamm der Saphena werden diese Verbindungsvenen sowie auch die klappenlosen Verbindungsvenen und die Venenstämme, zu denen sie hinführen, für die Saphena eintreten.

Wir werden uns nach dem Verschluss der Saphena bei A (vgl. Fig. S. 202) die Cirkulationsverhältnisse etwa so denken müssen: das Blut, welches von den Kapillaren her in die Anfangsvenen y und in die Varicen einströmt, wird durch die Verbindungsvenen xx in eine tiefe Vene abgeführt. Es wird die Varicen und das wie (S. 202) ein Steigrohr dienende untere Ende der Saphena nur soweit anfüllen, bis der Blutdruck hier und in dem damit zusammenhängenden Abschnitt der tiefen Vene, sagen wir der Tibialis gleich ist. Sobald der Druck grösser ist, fliesst das Blut nach Oeffnung der Klappen nach der Tibialis zu ab.

Wie die Cirkulationsverhältnisse vor der Unterbindung gewesen sind, davon kann man sich schwer ein genaues Bild machen. Auf jeden Fall sind die Verhältnisse verschieden je nach dem der Kranke ohne Muskelbewegung steht, oder geht und die Muskeln



Erklärung der Abbildungen auf Tafel V

spielen lässt. Im ersteren Falle wird das Blut in den tieferen noch mit Klappen versehenen Bahnen und im Kanalsystem der erweiterten Saphena sich lediglich durch die gleiche vis a tergo getrieben in gleicher Weise vorwärts bewegen. Sobald dagegen die Muskeln in Thätigkeit sind, tritt an den tieferen Bahnen das Pumpwerk der Venenklappen ins Spiel. Infolge dessen wird der Blutstrom in den tiefen Venen beträchlich schneller gehen; in den Verbindungsvenen xx wird das Blut abgesaugt werden. Es wird nicht ausbleiben können, dass das Blut aus dem Reservoir der gefüllten Saphena nachfließt und oben aus der Femoralis wieder ersetzt wird, so dass es sich in diesem Falle sozusagen um einen privaten Kreislauf der unteren Extremität handelt, indem das Blut in den tiefen Venen des Beines in die Höhe gepumpt wird und zum Teil in der Saphena wieder herunterfällt.

Wichtiger und klarer sind die Druckverhältnisse: nach der Unterbindung steht das Blut in den Varicen und den Anfangsvenen bei y unter dem in der Vena tibialis herrschenden Drucke, welcher (S. 203) verschieden sein wird je nachdem die nächstliegenden Klappen grade geöffnet oder geschlossen sind. Vor der Unterbindung dagegen standen Endvenen und Varicen ausserdem noch unter der Last der über meterhohen Blutsäule der Vena saphena, femoralis, iliaca und cava.

Dass der Einfluss der Druckverminderung auf Endvenen und Varicen nur ein günstiger sein kann, liegt auf der Hand. Früher waren die Gefässe nur während des Liegens von dem abnormen auf ihnen lastenden Drucke befreit. Jetzt sind sie es dauernd. Sie füllen sich viel weniger prall an und gewinnen allmählich einen Teil der verlorenen Elastizität wieder.

Von dem Vorhandensein von Verbindungsvenen, welche das Unterschenkelblut aus den Varicen nach der Tiefe zu abführen, kann man sich in jedem einzelnen Falle, ehe man sich zur Unterbindung der Saphena entschliesst, mit Leichtigkeit überzeugen. Komprimiert man bei horizontaler Lage des Kranken und bei noch gefüllten Varicen die Saphena, ehe man das Bein erhebt, und hebt dasselbe nun in die Höhe, so würden die Varicen gefüllt bleiben, wenn die Saphena der einzige abführende Kanal wäre. Dies ist aber nicht der Fall. Die Varicen entleeren sich, wenn

auch viel langsamer als bei nicht komprimierter Saphena. Es sind also in der Tiefe Nebenwege vorhanden, und zwar Wege, welche das Blut in der den normalen Cirkulationsverhältnissen entsprechenden langsamen Weise abfliessen lassen. Sollten auch diese tiefen abführenden Venen varicös entartet sein, was wahrscheinlich häufig genug vorkommt (Verneuil), so wird dieser Umstand von keinem Belang sein, so lange nur die Klappen der Vena poplitea und femoralis noch schliessen. Denn immer kommt es auf die Höhe der drückenden Blutsäule an, und die Höhe wird bestimmt durch die Lage der nächst oberen schlussfähigen Klappe.

Ebenso wird man sich in jedem einzelnen Fall durch den Kompressionsversuch vergewissern müssen, ob der erweiterte Hauptstamm der Saphena auch der einzige klappenlose Abführungsweg aus den Varicen ist. Denn bekanntlich kommen nicht selten Verdoppelungen des Stammes der Saphena in längerer oder kürzerer Ausdehnung vor, und wenn dann beide Stämme varicös erweitert sind, so wird die Unterbindung nur dann einen Erfolg haben können, wenn die Unterbindung an jedem der beiden Stämme oder an dem gemeinsamen Stamm oberhalb der Teilung vorgenommen wird. Gewöhnlich erweist sich die Stelle an der Grenze des mittleren und unteren (S. 204) Drittels des Oberschenkels, wo in der Regel die Erweiterung besonders stark ist, als der geeignetste Punkt für die Fingerkompression und also auch für die Unterbindung. Einigemal habe ich die Unterbindung höher oben, einigemal ausser an dem Hauptstamm auch an dem erweiterten Nebenstamm oder an der Saphena parva vorgenommen, welche ebenfalls erweitert war und mit der Saphena magna kommunizierte.

Ueber die Technik der Operation braucht kaum etwas gesagt zu werden. Durch einen etwa 3 cm langen Hautschnitt wird die Vene freigelegt und mit dem Skalpellsstiel isoliert. Sodann wird oben und unten mittelst der Aneurysmanadel ein Catgutfaden durchgeführt, das Bein erhoben um das Blut abfliessen zu lassen, die Vene doppelt unterbunden und zwischen den Ligaturen durchschnitten, worauf die Hautwunde durch Nähte geschlossen wird. Die Operation lässt sich in wenigen Minuten vollenden, und ist

nicht so schmerzhaft, dass die Narkose unumgänglich notwendig wäre.

Die blosse Unterbindung der Vene ohne Durchschneidung derselben wird nicht immer ausreichen, wiederholt sah ich früher nach Ausführung der Schede'schen Varicenunterbindung, wie die Venen an Stelle der Unterbindung allmählich wieder wegsam wurden. Andererseits braucht man nach der Durchschneidung der Vene eine Regeneration des Stammes natürlich nicht zu fürchten. Aeltere entgegenstehende Beobachtung beruhen sicher auf Täuschung. Man wird den zweiten Stamm einer doppelten Vene für den regenerierten einfachen Stamm gehalten haben. Minkewitsch<sup>3</sup> bekam bei seinen zahlreichen Tieversuchen niemals eine Venenregeneration zu sehen.

Der Erfolg der Unterbindung des Saphenastammes bleibt in den Fällen, in denen der oben erwähnte Kompressionsversuch gelingt, niemals aus und ist oft ein sehr überraschender. Besteht zur Zeit der Operation ein Ulcus cruris, so kommt dasselbe viel schneller zur Heilung, als bei anderweitiger Behandlung selbst in horizontaler Lage sonst der Fall ist. Die Unterschenkelvaricen sind, wenn der Kranke wieder aufsteht, natürlich nicht ganz verschwunden aber bleiben dauernd viel kleiner, als sie gewesen sind. Die Neigung zur Entstehung von Ulcera ist nahezu verschwunden.

(S. 205) In Bezug auf die einzelnen von mir operierten Fälle verweise ich auf die Dissertation von W. Tobold (Ueber Varicen der unteren Extremitäten und ihre Behandlung. Bonn 1889), welche über 9 Fälle aus den Jahren 1880–89 berichtet. In einem dort nicht mit aufgenommenen Fall konnte ich den Erfolg der Operation 5 Jahre hindurch kontrollieren. Die vor der Operation enorm ausgedehnten varicösen Venen sind dauernd viel weniger voluminös geblieben. Das Geschwür am inneren Knöchel, welches 3 Monate bestanden hatte und schon beim ersten Verbandwechsel 8 Tage nach der Operation geheilt war, ist nicht wieder aufgebrochen; die Patientin, jetzt 44 Jahre alt, kann

<sup>3</sup> J. J. Minkewitsch in Tiflis. Vergleichende Untersuchungen über die verschiedenen gegen Venen-Erweiterungen vorgeschlagenen (Varicen-) Operationen. Virchow's Archiv. Bd. 25 u. 48.

den ganzen Tage über am Waschfass stehen, ohne Beschwerden zu empfinden, und ist mit dem Erfolg in jeder Beziehung zufrieden.

Ein ausgezeichnete Erfolg wurde auch bei einem 46 jährigen Patienten erreicht, der in diesem Sommer zur Operation kam. Derselbe bemerkte die Varicen am rechten Unterschenkel schon im 15. Lebensjahre; im 20. Jahre war auch der Stamm der Saphena schon deutlich erweitert. Im 27. Jahre machte er den Feldzug nach Frankreich mit, und bekam durch Anschauern des Reitstiefels hinter dem inneren Knöchel ein Ulcus, welches bei mangelnder Pflege nur langsam heilte. Seitdem brach die Narbe fast jedes Jahr einmal für mehrere Wochen wieder auf, in den letzten Jahren kam es kaum mehr zu einer ganz soliden Vernarbung, meist blieb ein Schorf zurück, der sorgfältig gegen Verletzungen geschützt werden musste. Der Stamm der Saphena war fast von der Dicke eines Fingers, etwa ebenso dick waren im Stehen die Varicen am Unterschenkel, die Haut darüber stark verdünnt. Nach Unterbindung und Durchschneidung der Saphena an der Grenze des unteren und mittleren Drittels des Oberschenkels trat im Laufe einer Woche ganz solide Vernarbung des verschorften kleinen Geschwürs ein, am 13. Tage verliess der Patient geheilt das Bett, und schon 4 Wochen nach der Operation konnte er in der Schweiz eine beschwerliche Bergtour von 8 Stunden unternehmen. Jetzt ist vom Stamm der Saphena kaum noch etwas zu sehen, die Unterschenkelvaricen schwellen beim Stehen nur noch zur Dicke eines Taschenbleistifts an, und das quälende Gefühl der Ermüdung im ganzen Bein bei längerem Stehen ist vollständig verschwunden. Gummistrümpfe und Flanellbinde sind ganz entbehrlich geworden.

Ausgedehntere Thrombosen sind bei antiseptischen Wundverlauf durchaus nicht zu fürchten, abgesehen von den seltenen Fällen, in (S. 206) denen die Venenwand durch Verkalkung rigide geworden ist, so dass die Vene nicht kollabieren und sich vollständig entleeren kann. Bei einem meiner ersten Patienten kam es bei auch nicht ganz aseptischem Wundverlauf unter diesen Umständen zu einer unangenehmen Thrombosierung des Saphenastammes. Sonst kommen höchstens dicht unter der



Ligatur oder in den Varicen ganz cirkumskripte Thromben zu stande, welche ohne jede Bedeutung sind.—

Geht man die Geschichte der Chirurgie in Bezug auf die verschiedenen Methoden der Varicenoperationen durch, so ergibt sich als Resultat, dass die zahlreichen alten und neueren Methoden mit wenigen Ausnahmen ebenso wie die neuesten auf eine Entfernung oder Verödung der Unterschenkelvaricen durch operative Eingriffe hinzielen, welche an den Unterschenkelvaricen selbst zur Ausführung kommen. Die Operationen von Celsus, Galen, Avicenna verfolgen diesen Zweck ebenso, wie die neueren Verfahren von Ricord, Gagnebé, Velpeau, Bonnet, Fricke u. A. bis zu Schede und Madelung. Auch die Alten scheuten sich nicht, sehr grosse Stücke der varicösen Venen zu zerstören oder zu entfernen. Celsus legte die Varicen an verschiedenen, vier Finger breit von einander entfernten Stellen frei und zerstörte sie hier mit dem Glüheisen oder er schnitt sie an den verschiedenen Incisionsstellen durch und riss die Zwischenstücke heraus. Die Operation, welche Marius an sich vornehmen liess, wird sich also in Bezug auf radikales Vorgehen von den allermmodernsten Exstirpationsverfahren nicht wesentlich unterschieden haben. Nur musste der Römer die Operation ohne Chloroform aushalten und wird von Plutarch wegen seiner Standhaftigkeit bewundert, weil er den Fuss hinhielt, ohne sich anbinden zu lassen. (Als der Wundarzt das zweite Bein vornehmen wollte, zog er es allerdings zurück mit den Worten: ich sehe, dass die Heilung der Schmerzen nicht wert ist.) Ueber die Antisepsis, die den Hauptunterschied zwischen den alten und neuen Verfahren bedingt und deren Segen gerade den Varicenoperationen in besonderem Masse zu Teil geworden ist, brauche ich nicht zu sprechen.

Neben der Verödung der Varicen bezweckten dann die Alten bei ihren Operationen auch eine Entleerung des in den Varicen enthaltenen Blutes mit seinen Thromben, welches ihnen als verdorbenes galt. Besonders zu diesem Zweck scheint Paulus von Aegina (um 660 n. Chr.) den Stamm der Saphena geöffnet und dann unterbunden zu haben. Die Operation verlief in folgender Weise: um (S. 207) den Oberschenkel wurde oben eine schnürende Binde umgelegt. Der Weg der gespannten Saphena

wurde mit Tinte bezeichnet und oberhalb des Knies eine zweite Binde umgelegt. Sodann wurde die Vene mit dem Messer freigelegt und nach Lösung der Binden im oberen und unteren Wundwinkel je eine Ligatur unter der Vene durchgeschoben. Nun wurde die obere Ligatur geschlossen, die Vene mitten eingeschnitten und soviel Blut, als ratsam schien, aus derselben entleert, worauf auch die untere Ligatur zugezogen wurde. Das abgebundene Stück wurde excidiert oder man liess es sich später mit den Fäden exfolieren.

Ambroise Paré<sup>4</sup> beschreibt die Operation fast wörtlich ebenso und motiviert die Wahl des Ortes der Unterbindung in folgender Weise. "*L'on coupe souventesfois la varice au dedans de la cuisse, un peu au dessus du genouil, où à la plus part se trouve l'origine et production de la veine variqueuse. Car communément plus bas elle se diuise en plusieurs rameaux, à raison de quoy l'operation est plus mal-aisée. Or la cause pourquoy l'on incise, est à cette fin de couper le chemin, et faire rampart au sang et autres humeurs contenu avec luy, qui abbreuent quelques ulceres estans aux iambes: ou pour defendre les humeurs qui fluent a icelles, qui sont cause que le malade ne peut cheminer: ou pour la crainte qu'on peut avoir, que par quelque accident, la veine ainsi grandement estendue et dilatée, ne s'y face ouuerture, la quelle seroit cause d'um tres grand flux de sang, et causeroit la mort du malade, s'il n'estoit promptement secouru.*" Man sieht, nach Paré's Anschauung sollte die Unterbindung der Saphena den abnormen Blutzufluss nach den Geschwüren zu abschneiden, und wenn diese Anschauung auch auf der falschen theoretischen Voraussetzung beruhte, dass das Blut in den Venen vom Centrum zur Peripherie fliesst (Harvey's Entdeckung fällt in eine spätere Zeit), so trifft sie praktisch doch das Richtige.

Interessant ist, dass das Hin- und Herfluten des Blutes in grossen Varicen bei erweiterter Saphena schon vor dreihundert Jahren von Fabricius Hildanus<sup>5</sup> beobachtet und beschrieben worden ist. Anno 1589 ad quadragenarium quendam hic in vicinia virum robustissimum et optimo corporis habitu praeditum

<sup>4</sup> Ambroise Paré. XIIIème livre. Cap. XX.

<sup>5</sup> Fabricius Hildanus. Observat. chirurg. Centur. IV. Observ. LXXXV.

Adolphum auf dem Bruch nomine vocatus fui. Laborabat ille ulcere (S. 208) maligno et inveterato in tibia sinistra una cum varice ingentis magnitudinis. Crassitie enim brachium meum ad carpum adaequabat et spithamam fere erat longa. Incipiebat autem in ipso poplite et pedem versus descendendo gyrum et circumvolutiones duas efficiebat. Sed quod notandum, quam primum tibiam in altum elevabat, protenus retrocedebat sanguis. In terram vero posita tibia iterum descendebat et quidem in ipso momento. Et ut verbo dicam sanguis fluebat et refluebat non aliter, ac si in tubulo quodam nunc in hanc nunc in illam partem proiectus fuisset. Porro cum ulcera varicosa non prius abscisso varice consolidari nequiant—curationem aggressus sum (doppelte Unterbindung und Spaltung des Varix). Sic divino favore convaluit et ab eo tempore in hodiernum diem usque optima sanitate fruitur.

Dass den alten Chirurgen der günstige Einfluss von Varicenoperationen überhaupt auf die Heilung von Ulcera cruris bekannt war, liesse sich noch mit vielen anderen Stellen belegen. So sagt Marcus Aurelius Severinus: Ulcera bima, quadrina, septennaria, decennaria aut etiam diuturniora varicibus quae circumobsistebant excisis feliciter vidimus sanata. Die Geschwüre verschwinden, setzt er hinzu, wie die Pflanzen austrocknen, wenn der Bach abgeleitet wird.

Dass die Unterbindung des Stammes der Saphena wieder in Vergessenheit geriet, hing wahrscheinlich mit der Entdeckung des Kreislaufes zusammen. Jetzt waren die Venenstämme nur noch Abführungswege für das Blut, die varicöse Erweiterung liess auf Stauung schliessen, wie konnte da die Unterbindung des Stammes nützlich sein?

Am Ende des vorigen Jahrhunderts sehen wir die Idee wieder auftauchen. Everard Home<sup>6</sup> unterband in 12 Fällen den Stamm der Saphena dicht unterhalb des Kniegelenks, um Unterschenkelgeschwüre zu heilen und Varican zur Rückbildung zu bringen. In seinen lesenswerten Auseinandersetzungen bezeichnet er als nächsten Zweck der Operation "den Druck der in dem gemeinschaftlichen Stamm enthaltenen Blutsäule aufzuheben". Die

<sup>6</sup> Everard Home. On the treatement of ulcers etc. Uebers. v. Loder. 1799.

Insuffizienz der Klappen wird hervorgehoben, dass aber der Druck der Blutsäule nicht nur der Länge der Saphena, sondern der Entfernung des Varix vom Herzen entspricht, scheint Home entgangen zu sein.

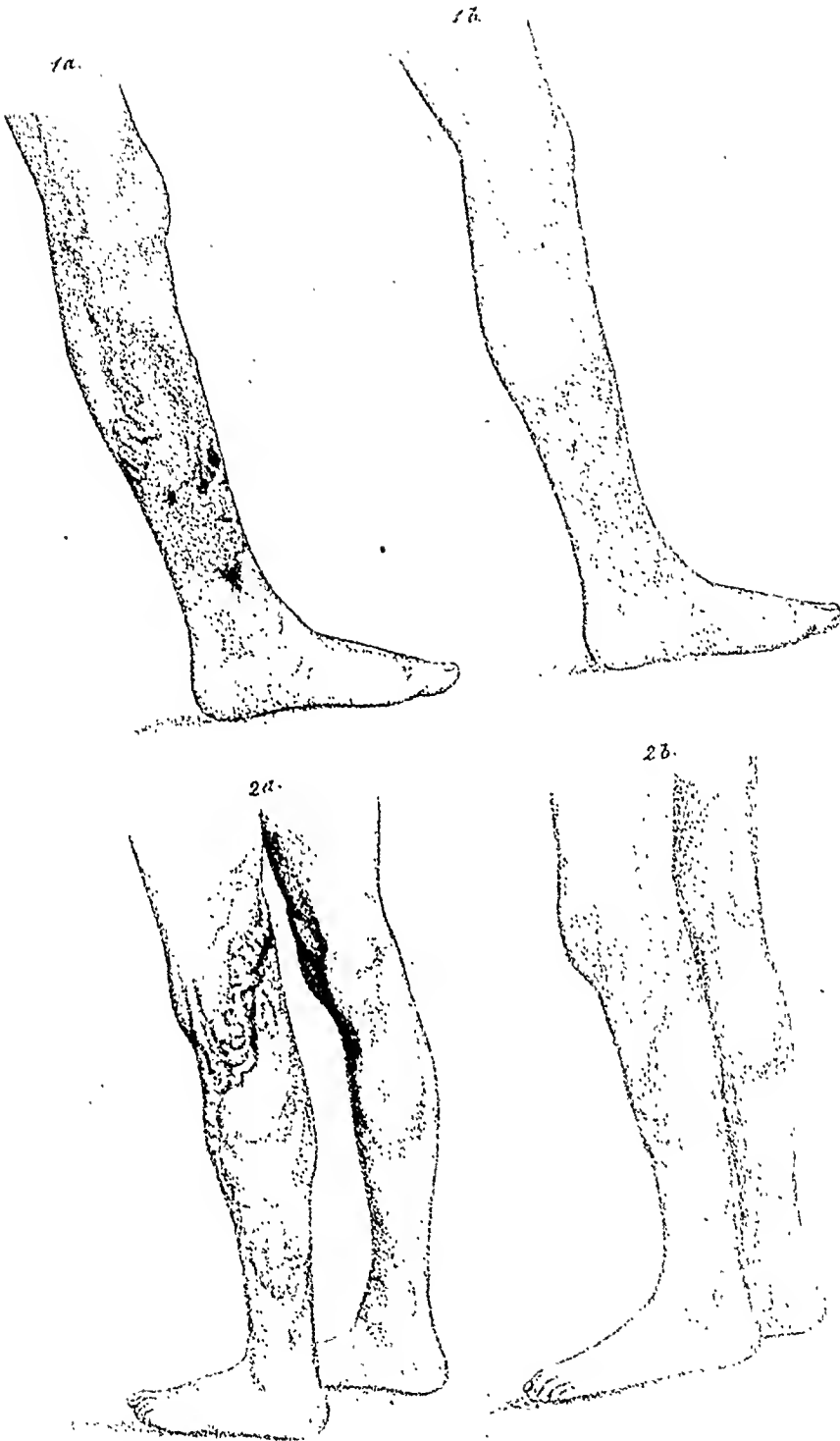
Liest man die Home'schen Krankengeschichten durch, so bekommt man den Eindruck, dass manche der Kranken nur mit (S. 209) knapper Not der Pyämie entgangen sind. Die verhältnismässig grosse Gefahr der Operation in vorantiseptischer Zeit ist es auch gewesen, welche sie nicht viel Beifall und Nachahmung finden liess. Praktiker wie A. Cooper verwarfen sie als zu gefährlich. Schreibtisch-Chirurgen, wie dem Mitarbeiter in Rust's Handbuch der Chirurgie, wollte die Theorie nicht einleuchten. So kam es, dass der richtige Gedanke zum zweitenmal in Vergessenheit begraben wurde. Die Operationen von Home werden nirgends mehr erwähnt und ich selbst bin erst kurz vor Abschluss dieser Zeilen auf sie aufmerksam geworden.

Endlich verdienen in geschichtlicher Beziehung noch die Mitteilungen von Ravoth über Druckbehandlung der Varicocele und der Phlebektasien an den Extremitäten erwähnt zu werden.<sup>7</sup> Schon vor Ravoth hatten Key, Curling, Tomsen, Morten bei Varicocele günstige Erfolge durch Applikation eines Bruchbandes mit federnder Pelotte auf den Leistenkanal erzielt. Ravoth fand die Wirksamkeit dieser Behandlungsweise durch eigene Erfahrung bestätigt, und versuchte sie nun der Analogie folgend auch für die Behandlung varicöser Erweiterung der Saphena und ihrer Aeste zu verwerten. Bei einem 28 jährigen Manne wurde die federnde Pelotte des Schenkelbruchbandes an der Einmündungsstelle der Saphena in die Femoralis aufgelegt. Nach zwei Monaten war eine deutliche Rückbildung der ektatischen Venen bemerkbar. Ravoth hoffte sogar auf eine vollständige Heilung des Leidens. Die Erklärung der günstigen Wirkung der Kompression sieht er der Hauptsache nach in der Entlastung der Vene von dem Drucke der auf ihr lastenden Blutsäule. Daneben spricht er aber auch von einer Cirkulationsbeschleunigung, welche durch die Kompression der Vene bewirkt werden soll. Bei der Varicocele vergleicht er die Cirkulationsbeschleunigung

<sup>7</sup> Berliner klin. Wochenschrift. 1874, 19 und 1875, 23.

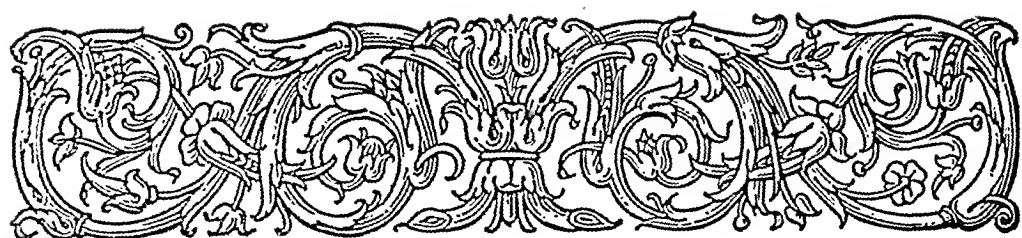
mit der Cirkulationsbeschleunigung, welche nach Slavansky in der Vena cava bei Reizung der Splanchnici auftreten soll! Diese unklare Vorstellung veranlasste Ravoth wohl auch, das Bruchband bei Phlebektasien der Saphena nicht nur bei Tage, sondern auch des Nachts, wenn der Kranke lag, tragen zu lassen, wo von einem abnormen Druck der Blutsäule doch kaum die Rede sein kann.

Ravoth ist es übrigens entgangen, dass schon Colles in Dublin dasselbe Verfahren angewandt hat. Verneuil erwähnt die Colles'sche Methode, sie scheint ihm aber so sehr im Widerspruch mit dem zu stehen, was wir über den Gang der Entwicklung der Varicen wissen, dass er es nicht für ratsam hält, sie anzuwenden (vgl. bei Minkewitsch l. c. pag. 236).



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Fig. 1.a. Unterschenkelvaricen bei einem 24jährigen Manne.  
 — 1.b. Dieselben bei komprimierter Saphena.  
 Fig. 2.a. Unterschenkelvaricen bei einem 43jährigen Manne.  
 — 2.b. Dieselben bei komprimierter Saphena.  
 (Nach photographischen Aufnahmen.)



# Ligation of the Great Saphenous Vein in Varicose Veins of the Leg

BY

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**T**HE cases of varicosities of the leg in the domain of the great saphenous vein can be separated into two different groups. There are cases in which the varicose deterioration is limited to the branches of the great saphenous vein, while the trunk shows no changes of any sort, and on the other hand, there are those in which the trunk of the saphenous is likewise markedly dilated and varicose. Only the last named group, the cases of simultaneous varicose dilatation of the trunk and the branches of the saphenous, will be considered in the following discourse.

A much more marked degree of this trouble is found more commonly in men than in women. The first trace of the change appears often even at the time of puberty and the history often reveals an hereditary tendency for dilatation of veins; along with the varicosities of the leg, hemorrhoids or a varicocele are found. In women repeated pregnancies play an important rôle etiologically.

The involvement of the trunk of the great saphenous strikes the eye at once when the naked limb is viewed. On the inner

## Varicose Veins

aspect of the knee joint behind the internal condyle of the femur and further up on the inner side of the thigh in the region of its lower third, the vein is seen as a slightly twisting strand, the size of a little finger to that of a thumb, climbing upward, distending the thinned out skin. At the junction of the lower and middle thirds an especially prominent circumscribed varix of about the size of a hazel nut or walnut is usually seen, and a second, still larger, can often be recognized further up close to the entrance of the vein into the fossa ovalis. It forms a somewhat flatter convexity than the first because it is covered with a thicker layer of fat. In the whole region of the upper two-thirds of the thigh the dilated saphenous is seen less definitely than in the lower third, except in extremely thin individuals. Below the knee joint the dilated trunk of the saphenous is transformed into the irregularly shaped, twisted and dilated branches, which on standing are tightly distended and show blue convolutions through the thinned out skin.

Both of these circumscribed varices of the trunk correspond to the location of valves in the vein, for as is generally known, in varicose deterioration of the veins, the places where valves lie share most markedly in the changes. If one removes such a circumscribed varix of the saphenous, then one finds both halves of the valves on the wall either unchanged as yet or partially eroded and shrunken down to lateral ridges. However, the largest diameter of the dilatation does not lie above the valve as one would believe, but, on the contrary, more often below it, not centrally but peripherally; a fact which up to now it appears, has not been suspected. Apparently the vein wall is weakest just below the valves, since under normal conditions, it has to bear the least pressure here. If the valves become insufficient because of dilatation of the vein, and the vein wall thus comes subjected to the abnormally high pressure of a longer column of blood, then this place would give way most easily to the pressure, and thus a circumscribed varix would develop here. Because of the numerous places in which valves are found in the saphenous vein (Klotz<sup>1</sup> found eight to eighteen of them), why

<sup>1</sup> K. Klotz (Braune). Investigations of the Saphenous Magnus Vein. Archiv für Anatomie und Physiologie. 1887. 159. ff.



just that spot at the junction of the lower and middle thirds of the thigh and the spot close to the entrance of the saphenous into the femoral in particular should be the site of a larger circumscribed varix, can not be explained from what as yet is known of the anatomy of the saphenous.

What gives the cases of varicosities of the legs with simultaneous dilatation of the trunk of the saphenous their special significance is the insufficiency of the valves of the saphenous trunk, which occurs with even comparatively slight widening of the lumen of the vein. The vena cava, the iliac vein, and the trunk of the femoral vein close below Poupart's ligament as a rule are known to have no valves at all.<sup>2</sup> As soon as the valves of the saphenous trunk become insufficient, then no valve closures are met with from the varicosities of the leg to the right heart. The vena cava, iliac vein, the upper part of the femoral and the saphenous with its branches form a single extensive system of tubes uninterrupted by any valve closure, the fluid content of which is kept in motion really by nothing but its weight.

This can be demonstrated in the following manner. If the patient lies down horizontally, then it is known that the varicosities of the leg at once become smaller and less tightly stretched, they remain moderately filled as long as they are below the level of the heart. If one raises the leg from the cot, then the higher the leg is raised over the level of the heart, the more rapidly they empty. On raising it to the perpendicular all the blood flows out with great rapidity and the air pressure presses the thinned out skin over the varices and the thin varix walls into the lumina of the veins. Where with standing patients the convolutions were prominent as a compact twisted tumor, now we see an exactly conforming system of pits and channels, comparable to the dried out bed of a stream.

If now, with the leg raised, one brings the upper body to a half sitting position, so that the heart and vena cava superior come to a higher level, then the saphenous partly fills with blood again. In thin individuals one can see and feel definitely how the menis-

<sup>2</sup> For exceptions see Friedreich. *Morphol. Jahrb.* III. 323.

cus of fluid corresponds approximately to the level of the heart. It mounts when the upper body is raised still higher and sinks when it is laid down. Vena cava, iliac vein and saphenous vein thus act as a communicating system of tubes in the physical sense.

In this experiment, the pressure in the abdominal cavity, as well as the weight, also naturally exerts an influence on the blood column in the saphenous. If we close one arm of a communicating glass U-tube with a thin rubber diaphragm and press on the the diaphragm with the finger, then the column of fluid in the other arm rises. Just so the blood column in the saphenous rises whenever the patient, in the position described, coughs, strains, or takes a deep breath. If now one lets the leg sink down so that the lower leg lies only slightly above the level of the heart, then on coughing one sees a low wave of blood run into the saphenous and its branches and flow away again. In the reclining patient the dilated saphenous thus forms a sort of manometer attached to the abdominal cavity. This is so sensitive that even flicking with the finger against the abdominal wall is answered by a slight movement of the fluid level.

If the patient now stands up from the cot then the whole canal system is at once filled tensely with blood, so quickly that it must be due to back flow along the iliac vein and not to a filling from capillary flow.

A very simple experiment will prove the correctness of this view. One lays the patient flat again, raises the leg to the perpendicular, lets all the blood flow out of the saphenous field and compresses the trunk of the saphenous with the finger at a spot where it is definitely recognizable. Now one lets the patient come down from the cot cautiously, without removing the compressing finger from the saphenous. We see that the whole saphenous vein now remains empty at first on standing. Not until the lapse of a quarter to a half a minute does one see the varicosities in the leg gradually begin to fill with blood again. The fullness, however, is not nearly so tense as it previously was, as long as pressure on the trunk persists. Only when one removes the compressing finger, does a larger amount of blood

rush down from above into the saphenous and the old picture of the tensely distended varicosities returns.

The blood, which under usual conditions, fills the bed of the varicose saphenous thus in only a small part comes back from the capillaries; for the greater part it has flowed back from the iliac vein. The dilated trunk of the saphenous behaves like a stagnant arm of a river delta, its filling is dependent more on the ebb and flow of the sea than on the flow of the river water.

The amount of blood which flows down from the iliac into the saphenous when the patient changes from the horizontal position to the upright, is very considerable where there is marked dilation of the saphenous and its branches. I have previously tried to measure the quantity by having the patient place the leg with the saphenous compressed in a high cylindrical vessel filled with water, and then measuring the amount of water which overflowed after compression ceased. The experiment struck technical difficulties and did not give exact results. Nevertheless, the amount of back flowing blood could be estimated at 200 to 250 grams.

The back flow of the blood from the iliac vein and the vena cava is what makes the bleeding from a burst varix with a dilated saphenous so profuse and dangerous. Indeed the blood squirts out of a hole scarcely the size of the head of a pin in a regular stream as a result of the pressure of the high blood column, and if a somewhat larger varix bursts the bleeding is just as profuse as from a large artery. Death from hemorrhage has been seen repeatedly to occur within a few minutes. The force which drives the blood out is the weight alone, and if the patient thus falls over unconscious at once or if he has the right instinct or presence of mind to lay himself down horizontally at once then the bleeding must stop.

But not only the varices of the larger venous branches but also the smallest, scarcely visible skin veins on the leg, on the inner aspect of the ankle and the dorsum of the foot, are under the influence of the abnormally high pressure of the blood, inasmuch as they belong to the bed of the saphenous. Also they are only partly fed in the normal way from the capillaries, their tense filling depends on the back flow of the blood down from above,

just as does the filling of the larger varices. This may also be proved by the above described experiment. In this one watches the finely grained design of the blue and carmine small ectatic cutaneous veins as they are found in the lower leg, the medial aspect of the ankle and the dorsum of the foot on standing. One lays the patient flat with the leg raised, compresses the saphenous and lets him stand again. As long as the compression persists the skin remains fairly pale; as soon as the compression ceases it takes its usual livid color again.

An abnormal pressure in the smallest veins must furthermore disturb the circulation in the capillary network substantially. It is thus understandable that with long standing not only edema occurs but also a disturbance of nutrition of the skin gradually arises, which hinders the prompt healing of small wounds and which, because of the scanty protection against local sepsis, allows for the development of an independently enlarging ulcer from the most insignificant small erosion. The healing of such an ulcer, as is well known, occurs only with great difficulty as long as the patient does not remain in bed and thus relieve the tissue of the pressure of the blood column. Also the scar breaks down easily, and it is not always injuries of the scar by a blow which causes it to break down as this can also occur spontaneously.

In such cases, if one has the opportunity to observe the scar in the time immediately before the breaking down, then one can see that the first disturbance is hemorrhage into the scar tissue. During strong bodily exertion, which raises the pressure in the veins, the patient feels a slight pain in the scar and a blue-black discoloration appears in the scar which as yet is externally intact, the spot remains somewhat sensitive, the covering epithelium is sloughed off after several days or weeks and a bloody serous fluid which contains crumbly fragments of the inspissated bloody extravasation is secreted. Under favorable conditions there is then formed a dry crust, under which the loss of substance is gradually replaced, with scanty antiseptic pyogenic cocci filter in, an inflammatory infiltration of the surrounding region occurs and the ulcer is back.

If thus the simple fact that the varicose branches of the

saphenous are separated from the vena cava by no valve closures as a result of the simultaneous dilatation of the trunk causes a large part of the difficulties and dangers to which the sufferers from varicosities of the legs are subject, then the next thought is to prevent the back flow of blood from the vena cava through the saphenous into the varices operatively, by a permanent closure of the saphenous at one place, and at the same time to relieve the veins of the lower leg and foot from the abnormal pressure which burdens them. Such a permanent closure can be produced easily and without danger by double ligation and section of the vein between the ligatures, and as I have used this operation since the year 1880 in a large series of cases with the best results, I can recommend it for all cases of lower leg varicosities with simultaneous dilatation of the saphenous.

To those to whom the hydrostatic relations described have not been made clear, who think only of the primary origin of the varicosities in many cases as compression of the iliacs (pregnancy, etc.), it will at first appear strange to attempt to relieve the congestion by ligation of the efferent channel. But we must remember that it is not the ligation of the iliac or the femoral vein with which we are dealing but, on the contrary, with the ligation of the great saphenous which is not the only efferent channel from the bed of the branches of the saphenous. On the one hand there are communications with the deep venous tracts, on the other hand with the lesser via the dorsal arch as well as often by direct communications. According to the investigations of Klotz and others these communicating veins have valves in part, and even if all the valves are not so placed as to direct the blood from the saphenous into other trunks, as Luschka believes, this relationship does exist in part in the communicating veins, and with the trunk of the saphenous closed, these communicating veins as well as the valveless communicating veins and the venous trunks to which they lead will substitute for the saphenous.

After the closure of the saphenous at "A" (compare with figure on p. 202) we must think of the circulatory relationship as this: the blood which flows from the capillaries into the beginning

veins "y" and the varices will be conducted off to the deep veins through the communicating veins "xx". The varices and the lower end of the saphenous serving as an ascension pipe will fill only as long as the blood pressure here and in the connected segment of the deep vein, we will say the tibial, is the same. As soon as the pressure becomes greater the blood will flow off to the tibial when the valves open.

It is very difficult to form an exact picture as to what the circulatory relationships were before the ligation. In every case the relationships vary according to whether the patient stands without muscular activity or moves about and allows for the play of the muscles. In the first case the blood in the deep tracts provided with valves and in the dilated saphenous will be driven by practically the same *vis à tergo* and moved forward in the same way. On the other hand, as soon as the muscles come into action the pumping action of the venous valves in the deep tracts come into play. As the result of this the blood stream in the deep veins will move appreciably faster; the blood will be sucked out of the communicating veins "xx". It will not remain out since the blood from the reservoir of the filled saphenous flows after and is replaced from above from the femoral, so that in this case we are dealing with an independent circulation of the lower leg so to speak, in that the blood in the deep veins of the leg is pumped up and in part flows down again through the saphenous.

The pressure relationships are more important and more clear: after ligation the blood in the varicosities and in the beginning veins at "y" is under the pressure prevailing in the tibial vein, which varies according to whether the nearest lying valves have just opened or closed. Before the ligation, however, the end veins and varicosities were under the burden of the column of blood, over a meter in height, in the saphenous, femoral, and iliac veins and the vena cava.

It is obvious that the influence of the decrease of pressure on the end veins and varicosities can be only beneficial. Previously the vessels were freed from the abnormally burdensome pressure only on lying down. Now this is permanent. They fill less tensely and gradually regain a part of their lost elasticity.

One can easily test for the presence of communicating veins which lead the blood of the leg from the varices to the deep vessels in each case before deciding to ligate the saphenous. If one compresses the saphenous with the patient in the horizontal position with the varicosities still filled before raising the leg, and then raises it on high, the varices will remain filled if the saphenous is the only efferent channel. But this is not the case. The varicosities empty themselves although much more slowly than with the saphenous not compressed. Thus there are accessory passages in the depths, and indeed, passages which allow the blood to flow off in a correspondingly slow manner under normal circulatory conditions. Should these deep efferent veins also be varicose, as apparently happens quite commonly (Verneuil), then this condition will be of slight importance as long as the valves of the popliteal and femoral veins still close. For what always is important is the height of the pressing column of blood and the height is determined by the position of the next valve above which is capable of closing.

Thus one must determine in every single case by means of the compression test, whether the dilated main trunk of the saphenous is the only valveless efferent passage from the varicosities. For not rarely it is known that duplication of the trunk of the saphenous throughout a greater or lesser extent occurs and then if both trunks are dilated, the ligation can have an effect only if the ligation is done on both the trunks or on the common trunk above the separation. Generally the spot at the junction of the lower and middle thirds of the thigh, where as a rule the dilatation is especially marked, proves to be the most favorable point for finger compression and also for ligation. Several times I have done the ligation higher up, several times in addition to the main trunk on the dilated accessory trunk or on the lesser saphenous which was also dilated and communicated with the greater saphenous.

Scarcely anything needs to be said on the technic of the operation. The vein is exposed through a skin incision about 3 cm. long and isolated with the handle of the scalpel. Then a cat-

gut suture is passed around above and below by means of an aneurysm needle, the leg raised in order to allow the blood to flow off, the vein doubly ligated and severed between the ligatures, whereupon the skin incision is closed by suturing. The operation can be completed in a few minutes and is not painful enough that narcosis is indispensably necessary.

The mere ligation of the vein without section of it will not always suffice; previously I have repeatedly seen how the veins gradually become passable at the site of ligation after carrying out the Schede varix ligation. On the other hand, naturally one need not fear regeneration of the trunk after cutting through the vein. Older contrary observations surely must be based on misinterpretation. The second trunk of a double vein has been taken for the regenerated single trunk. Minkewitsch<sup>3</sup> never saw a regeneration of a vein in countless animal experiments.

The result of ligation of the saphenous trunk, in the cases in which the compression test described above is successful, never fails and is often very surprising. If a crural ulcer is present at the time of operation it heals much more quickly than is the case with the other sort of treatment in the horizontal position. The varicosities of the leg naturally do not disappear completely when the patient stands but remain much smaller than they had been. The tendency toward the development of ulcers practically disappears.

In regard to the individual cases operated on by me I point to the dissertation of W. Tobald (*Varicosities of the Lower Extremities and Their Treatment*. Bonn. 1889) which reports on 9 cases from 1880 to 1889. In one case not taken up there I was able to evaluate the result of the operation five years later. The extensive enormous varicosities present before operation have remained permanently less voluminous. The ulcer on the inner ankle, which had been present three months, was healed already at the first change of dressing eight days after operation, and has never broken down again; the patient, now 44 years of

<sup>3</sup> J. J. Minkewitsch in Tiflis. Comparative Investigations on the various operations proposed for vein dilatations (Varices). *Virchow's Archiv*. Bd. 25 u. 48.



age, can stand the whole day over the wash tub without feeling any discomfort and is satisfied with the result in every respect.

An excellent result was also obtained in a 46 year old male patient who came to operation this summer. He noticed the varicosities in the right leg as early as his 15th year; in the 20th year the trunk of the saphenous was already definitely dilated. In his 27th year he accompanied the military expedition to France and from the chafing of the riding boot got an ulcer which healed very slowly with scanty nursing. Since then the scar has broken open for several weeks every year, in the latter years it scarcely longer formed a wholly solid scar, for the most part a crust remained which had to be protected from injury most carefully. The trunk of the saphenous was almost as thick as a finger and the varicosities on the lower leg were almost as thick on standing. The overlying skin was markedly thinned out. After ligation and section of the saphenous vein at the junction of the lower and middle thirds of the thigh an entirely solid cicatrization of the little crusted ulcer occurred in the course of a week, on the 13th day the patient left his bed cured, and already four weeks after the operation he was able to undertake a difficult mountain climb of eight hours in Switzerland. At present hardly anything is to be seen of the trunk of the saphenous, the varicosities of the lower leg on standing swell only to the size of a pocket pencil and the tormenting feeling of tiredness in the whole leg on standing has disappeared completely. Rubber stockings and flannel binding have become entirely unnecessary.

Extensive thromboses need not be feared with antiseptic wound treatment, except for the rare cases in which the vein wall has become rigid from calcification so that the vein can not collapse and empty itself completely. In one of my first patients under these conditions and with a wound course that was not entirely antiseptic, an unpleasant thrombosis of the saphenous trunk occurred. Otherwise, thrombi, which are without any significance, form close beneath the ligature or in the varices for the most part.

If one goes back through the various methods of vein operations in the history of surgery, he finds that the numerous old

and newer operations, with few exceptions, just as the most recent, are aimed at the removal or the obliteration of the varicosities of the legs by operative intervention, performed on the varicosities of the leg themselves. The operations of Celsus, Galen, Avicenna followed just this plan, as do the more recent procedures of Ricard, Gagnebe, Velpeau, Bonnet, Fricke and others up to Schede and Madelung. Also the ancients did not fear to destroy or to remove large portions of the varicose veins. Celsus exposed the veins with various incisions separated from each other by the breadth of four fingers and destroyed them here with the cautery or he cut them at the various points of incision and tore out the segments in between. The operation which Marius allowed him to perform on himself thus did not differ materially from the most modern extirpation procedures in regard to the radicalness. Only, the Roman had to endure the operation without chloroform and was marveled at by Plutarch for his steadfastness, because he held his foot out without being bound. (As the surgeon wished to take the second leg, he drew it back with the words: "I see that the cure is not worth the pain".) Concerning antisepsis, which is the chief difference between the ancient and modern procedures and the blessing of which is especially a part of the varix operations, I need not speak.

Along with the obliteration of the varices the ancients also aimed at emptying the blood and the thrombi contained in the varices which they took to be bad. Paulus of Aegina (about 660 A.D.) appears to have opened the trunk of the saphenous especially for this purpose and then to have ligated it. The operation ran in the following way: Above, about the thigh a shurred ligature was placed. The course of the distended saphenous was marked out with ink and a second tourniquet placed above the knee. Then the vein was exposed by the knife and after loosening the tourniquets, a ligature was shoved under the vein at the upper and lower extremities of the wound. Then the upper ligature was closed, the vein cut through in the middle and as much blood as seemed advisable emptied from it, whereupon the second ligature was tied. The tied off portion was excised or allowed to slough out later with the threads.

Ambrose Paré<sup>4</sup> describes the operation almost word for word just so and accounts for the choice of the place of ligation in the following way. "One usually cuts the varix on the inner part of the thigh, a little above the knee, where a varicose vein is usually found to develop. Because usually farther down it is divided into several branches, by reason of which operation is more difficult. Now the reason why one operates is for the purpose of cutting the channel and making a barrier against the blood and other humours contained with it, which fill any ulcers present in the legs; or to prevent the humours which flow to them and are the cause of the inability of the sick man to move about; or for the fear one may have that some accident the vein, thus greatly distended and dilated, may rupture of itself, which will cause a great bloody flux and may bring about the death of the patient, if he is not promptly aided." One sees, according to Paré's views, that the ligation of the saphenous should cut off the abnormal flow of blood to the ulcers and, even if this view does rest on a false theoretical foundation, that the blood in the veins flows from the central to the peripheral portions (Harvey's discovery occurred at a later date), for practical purposes, it is correct.

It is interesting to note that the flow of blood hither and thither in the large varices with dilated saphenous was observed and described as early as three hundred years ago by Fabricus Hildanus.<sup>5</sup> "In the year 1589 I was called to a certain very strong forty year old man in this neighborhood, who was endowed with a very fine physique and who was called Adolphus of the Marsh. He was suffering from a malignant and chronic ulcer of the left tibia along with a varix of immense size. It equaled in thickness my arm at the wrist and was almost a span (9 in.) in length. Moreover, it began in the popliteal space itself and in descending toward the foot it made a turn and two revolutions. But what should be especially noted, as soon as he lifted the tibia up the blood immediately receded. When the tibia was placed upon the ground the blood again descended,

<sup>4</sup> Ambrose Paré XIIIeme livre. Cap XX.

<sup>5</sup> Fabricus Hildanus. Observat. chirurg. Centur. IV. Observ. LXXXV.

indeed instantly. To speak briefly, the blood flowed and flowed back as if it had been thrown now in this direction, now in that, in a tube. Moreover, since the varicose ulcer could not be healed solidly until the varix was severed, I attempted a cure (double ligation and division of the varix). But by divine favor he got well and from that time until today he has always enjoyed excellent health."

That the ancient surgeons were familiar with the favorable influence of varix operations on the healing of crural ulcers, can be gathered from many other sources. Thus Marcus Aurelius Severinus said, "Ulcers that continue for two years, four years, seven years or ten years or even longer we have seen successfully cured by excision of the varices which offered resistance". The ulcers disappear, he added, as the plants dry up when the stream is diverted.

That the ligation of the saphenous again fell into oblivion is probably due to the discovery of the circulation. In as much as the venous trunks were only efferent passages for the conduction of the blood and the varicose dilation was due to congestion, how could ligation of the trunk be of benefit?

At the end of the previous century we see the idea again taken up. Everard Home<sup>6</sup> ligated the trunk of the saphenous just below the knee joint in twelve cases, in order to heal ulcers of the leg and bring about a regression in the varicosities. In his exposition, which is well worth reading, he designated "the elimination of the pressure in the blood column contained in the common trunk" as the immediate purpose of the operation. The insufficiency of the valves was missed, that the pressure of the blood column corresponded not only to the length of the saphenous but also to the distance of the varix from the heart, appears to have escaped Home.

If one reads through Home's case histories than one gets the impression that many of the patients escaped pyemia only with the greatest difficulty. It was the comparatively great danger of the operation in pre-antiseptic times which brought it no

<sup>6</sup> Everard Home. On the treatment of ulcers etc. Uebers. v. Loder. 1797.

great approbation or imitation. Practitioners such as A. Cooper discarded it as too dangerous. Author-surgeons, like the co-workers in Rust's Handbook of Surgery, would not explain the theory. Thus it happened that the true idea was buried in oblivion for a second time. The operations of Home were mentioned nowhere any longer and I, myself, became aware of them only a short time before the conclusion of these lines.

Finally, from an historical point of view, the contributions of Ravoth<sup>7</sup> on the pressure treatment of varicocele and the phlebectasias of the extremities deserves to be mentioned. Ravoth, Key, Curling, Tomsen and Morton had already previously obtained favorable results in varicocele by the application of a truss with an elastic pelotte over the inguinal canal. Ravoth confirmed the effectiveness of this method through his own experience, and then, following the analogy, sought to make use of it in the treatment of varicose dilatation of the saphenous and its branches. In a twenty-eight year old man the elastic pelotte of a femoral hernia truss was placed over the entrance point of the saphenous into the femoral. After two months a definite regression of the ectatic veins was noticeable. Indeed Ravoth hoped for a complete cure of the affliction. The explanation of the favorable effect of the compression he saw to be chiefly the freeing of the veins from the pressure of their burdensome column of blood. However he spoke of a speeding up of the circulation which was said to be brought about by the compression of the veins. In the case of varicocele he compared the increase in circulation with that increase in circulation which occurs, according to Slavansky, in the vena cava on stimulation of the splanchnics! Ravoth also made the unintelligible assertion that the truss in phlebectasia of the saphenous should be worn not only by day but also at night when the patient lies down, when one can scarcely speak of an abnormal pressure of the blood column.

Moreover it also escaped Ravoth that Colles in Dublin had already used the same procedure. Verneuil mentions Colle's

<sup>7</sup> Berliner klin. Wochenschrift. 1874, 19 and 1875, 23.

method, but it appears to him to be in such contradiction to what we know of the process of development of the varicosities that he did not think it advisable to use it. (Compare with Minkewitsch l. c. pag. 236.)

Explanation of the illustrations in Plate V.

Fig. 1.a. Varicosities of the leg in a 24 year old man.

— 1.b. The same with saphenous compressed.

Fig. 2.a. Varicosities of the leg in a 43 year old man.

— 2.b. The same with compressed saphenous.

(From photographic reproductions.)

THE END.



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VOLUME IV



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## Abraham Colles

### BIOGRAPHY

- 1773 Born July 23, at Millmount, Kilkenny, Ireland. His grandfather was a doctor and his father managed a marble quarry. He attended Kilkenny Grammar School.
- 1790 Age 17. Entered Trinity College, Dublin.
- 1795 Age 22. Obtained diploma of the Irish College of Surgeons.
- 1797 Age 24. Received M.D. at Edinburgh. Visited London, assisting Astley Cooper in dissections.
- 1799 Age 26. Returned to Dublin and became resident surgeon in Steevens Hospital.
- 1802 Age 29. President of the Irish College of Surgeons.
- 1803 Age 30. Became surgeon to Cork Street Fever Hospital.
- 1804 Age 31. Appointed professor of anatomy and surgery at the University of Dublin until 1836.
- 1807 Age 34. Married Sophia Cope, the daughter of a Galway rector, and had six sons and four daughters.
- 1811 Age 38. First in Ireland to tie the subclavian artery. Described Colles' fascia.
- 1813 Age 40. Became visiting surgeon to Steevens's Hospital and to Meath Hospital, Dublin.
- 1814 Age 41. Described fracture of radius (Colles' fracture).
- 1830 Age 57. President (for second time) of Irish College of Surgeons.
- 1837 Age 64. Stated Colles' law.
- 1839 Age 66. Offered baronetcy, but declined it.
- 1841 Age 68. Resigned as surgeon to Steevens Hospital because of ill health.



- 1843 Age 70. Died Nov. 16 of a weakened and dilated heart, chronic bronchitis and emphysema of the lungs, with congestion of the liver, all occurring under the influence of a gouty constitution, according to Dr. William Stokes who attended him.

Colles was of about medium size, well proportioned and of a dignified manner, with a shrewd, clear eye, a fine forehead and a decided mouth. (Doescher.)

### EPONYMS

**FASCIA:** The connection of the middle perineal fascia overlying the muscles of the perineum, and continuous around the border of the transverse perineal muscle with the base of the triangular ligament; the deep layer of the superficial perineal fascia.

**FRACTURE:** Of the carpal extremity of the radius.

**LAW:** A child that is affected with congenital syphilis, its mother showing no signs of the disease, will not infect its mother; also called Colles'-Baumès' law.

**LIGAMENT:** A portion of the aponeurosis of the external oblique muscle, extending from Poupart's ligament to the linea alba; the reflected inguinal ligament or triangular fascia.

**SPACE:** Under the perineal fascia containing the transversus perinei, ischiocavernosus, and bulbocavernosus muscles, the posterior scrotal or labial vessels and nerves, and the bulbous portion of the urethra.

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## INTRODUCTION

Abraham Colles is known as the greatest of Irish surgeons. After receiving his preliminary education in Dublin, he completed his medical education in Edinburgh and then became an assistant in the anatomical laboratories of Sir Astley Cooper in London. His training was that of one of the best surgeons of his day, a thorough grounding in anatomy, active practice and subsequent specialization in operative work. At the age of 29 he became for the first time President of the Irish College of Surgeons. He carried on a busy practice but always took time to make careful studies of his patients and their pathologic processes. He was especially interested in recognizing deviations from normal anatomy.

Colles' publications are few but the quality of them and the new ideas they contain compensate for the limited number. One of the most valuable of his writings is a *Treatise on surgical anatomy* published in 1811. Here we have a fine example of the way in which both anatomy and surgery have benefited by the union of these two subjects under one teacher in the old-time medical schools. Colles had recognized certain limitations or extensions of urinary extravasations and by anatomic dissection he had demonstrated the extent and attachments of the perineal fasciae. He thus was able to show why urine escaping from a rent in the bladder or urethra had to pass in definite directions. His knowledge was of a practical nature but instead of making much ado about a new discovery he described it as a matter of course and went on about his work. The chapter of Colles' *Surgical anatomy* which describes the anatomy of the perineum is reproduced here in its entirety.

By the modern dissociation of anatomic and surgical teaching the description of the perineal fasciae has become confused. As an example, Colles' fascia is easily demonstrated surgically when extravasation of urine takes place beneath it, but the fascia is not easily dissected on the dry cadaver. Recent textbooks, if mentioning Colles' fascia at all, have described it incorrectly. Therefore, a study of Colles' original description is of great value. A good description of Colles' fascia is in *The clinical importance of Buck's and Colles' fasciae* by M. B. Wesson, Surg. Gynec. Obstet., 42: 208-213, 1927. Also see Nelson's *Surgery*, New York, Nelson, 6: 45, 1928.

In 1811, the same year in which Colles published his *Treatise on surgical anatomy*, he operated on a patient with aneurism of the subclavian artery. Within the next four years he had treated three patients with a similar condition and in two of them he had tied off the subclavian artery. Colles' description, published in 1815, herein reproduced, is an interesting picture of surgical practice in his day. We are made to realize the detailed anatomical study which Colles made in preparation for these operations.

Colles' name is today known by every medical student as a practitioner in connection with a common fracture of the wrist of a

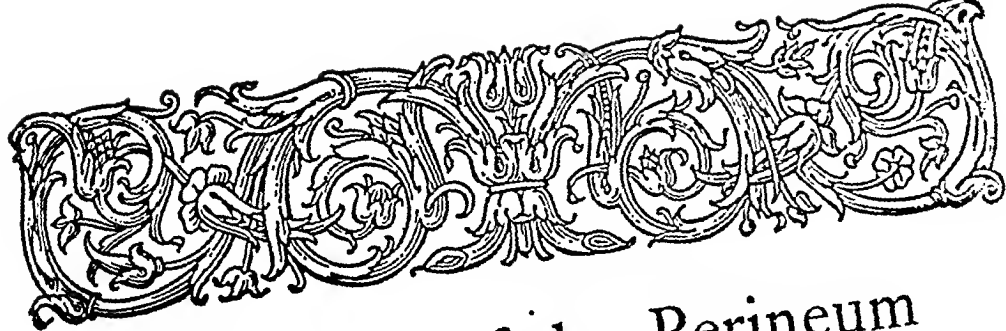
he described in 1814, at the age of forty-one. The article *On the fracture of the carpal extremity of the radius*, herein reproduced, consists of only 1,528 words, a model of concise value that could be studied with advantage by most writers of medical literature today. The account describes the impaction, the characteristic deformity, the ease of reduction, the difficulty of maintaining reduction and a satisfactory method of treatment. All this was before the day of x-rays. Truly, Colles must have been a careful clinical observer.

Surgical works before 1814 failed to mention this type of fracture. Colles' teacher, Astley Paston Cooper, and the latter's teacher, John Hunter, did not mention this injury. Even more interesting is the fact that those written after Colles' clear description omit reference to him or his work. Thus Sir Astley Paston Cooper in *Surgical Essays*, 1. Amer. 3. London ed., Philadelphia Webster, 1821 Samuel Cooper in *Dictionary of Practical Surgery*, from 4. London ed., New York, Collins, 1822 and *Surgery*, 4. Amer. from 7. London ed., New York, Wood, 1844, and Velpeau, 2. ed., Paris, Baillière, 1839, all fail in this respect. On the other hand, Sir Astley Paston Cooper in *A treatise on dislocations*, 2. Amer. from 6. London ed., Boston, Lilly, 1832, p. 470 does describe this type of fracture but does not mention Colles' name or method of treatment.

Today, with the aid of x-rays, we recognize that this fracture is of frequent occurrence; we can visualize the exact position of the bone ends and can be sure that reduction is complete and permanent. We know, as Colles taught us, that lack of reduction or only temporary reduction, is very deforming and disabling. We certainly owe a great debt to Colles for this contribution.

In 1837, at the age of 64 and after many years of active service as an anatomist and surgeon, Abraham Colles published a book, *Practical observations on the venereal disease, and on the use of mercury*. On page 173 of the American edition he stated a rule of syphilitic infection which is still called either Colles' law or immunity; "I have never seen or heard of a single instance in which a syphilitic infant, (although its mouth be ulcerated,) suckled by its own mother, had produced ulceration of her breasts...." We now know, with the aid of the Wassermann test, that Colles' deduction from his clinical experiences was incorrect. The reason the mothers observed by Colles did not develop syphilis was because they already had the disease in a latent form. But Colles wrote his observations 68 years before the organism of syphilis was discovered by Schaudinn and 69 years before the serologic test of Wassermann. A few pages of Colles' book are reproduced because they disclose the observations of the author and the state of knowledge of syphilis in his time. How many of our observations of today will be obsolete in a few years?

From the selections here reprinted we see that Abraham Colles, in addition to being the first surgeon of Ireland, was a leading medical observer of his time and an influence which still lives.



# Anatomy of the Perineum

Published in *A Treatise on Surgical Anatomy*

BY

ABRAHAM COLLES

One of the Professors of Anatomy and Surgery in the Royal College of Surgeons in Ireland, &c.

Dublin, Gilbert and Hodges, 1811. pp. 174-180

**N**OW proceed to dissect the perineum. Raise the skin of the perineum, extending the dissection beyond the tubera ischii to the thighs. This exposes to view a strong fascia, which, on dissection, will be found to cover the entire of the perineum, and to blend itself with the structure of the scrotum. This fascia, although on a superficial view it appears continuous with the fascia of the muscles of the thigh, will yet be found, on closer examination, to attach itself very firmly to the rami of the ischium and pubis. The texture and connexions of this fascia will serve to explain many of those phenomena attendant on the effusion of urine into the perineum, by rupture or ulceration of the posterior part of the canal of the urethra.

First, then, you will find that this fluid, when so effused, although it forms a tumour in perineo, rarely terminates by suppuration and ulceration in this spot; being here resisted by the dense and unyielding texture of the fascia, diffusion laterally towards the thighs is prevented by the close attachment of this fascia to the rami of the pubis and ischium; while its progress forwards is favoured by a quantity of cellular substance, interposed between the surface of the perineal muscles and this fascia.

perineum.  
mode of dissecting it.

dissection of the perineum.

effusion of urine.

In general, then, we find that the urine having caused some tumefaction in perineo, passes on into the scrotum. Here meeting with only a very feeble resistance from the lax texture of this part, it quickly distends it to a very considerable size. In some instances the mischief does not extend further, for suppuration takes place in the scrotum, and a quantity of very fetid fluid, composed of urine and pus, is discharged as soon as the abscess spontaneously bursts, or is opened by the surgeon. In other cases, the effused urine continues its progress until it arrives at the pubis. Here it causes a swelling, which becoming red, tense, and painful, at length ulcerates; and giving exit to a large and fetid discharge of urine mixed with pus, affords some relief to the patient. As often as the patient attempts to pass urine, some of it filters through this opening. In process of time, considerable sloughs of cellular substance are drawn out through it. After this the swelling subsides, the orifice contracts, and the disease terminates in an urinary fistula.

In some cases, besides the opening on the pubis, an extensive gangrene seizes on the integuments of the perineum or scrotum. During the progress of this local mischief, the constitution of the patient suffers very materially. He is from the commencement afflicted with severe pain, and some degree of fever. By the continuance of this, his life is brought into imminent hazard.

By making an incision into the perineum, in the early stage of the disease, the patient will be saved from many of these evils; the painfulness of the disease will be diminished; the period of its continuance shortened; and the ravages of the malady confined within much more narrow and circumscribed limits.

In cases of abscess in perineo, the dense texture, and unyielding nature of this fascia, will prevent the fluctuation from being sensibly felt, and will also retard the spontaneous discharge of the matter. An early opening made into the abscess, is therefore necessary, to free the patient from the protracted state of suffering, which the confinement of the matter in this situation will cause.

Before you raise this superficial fascia of the perineum, it may be of use to make a transverse incision through it, midway between the tuberosities of the ischia and the arch of the pubis.

This incision will enable you to see the muscles of the perineum, lying in their natural situations. From this view you observe, that these muscles are closely joined to each other, that no interval exists between the erector penis and the accelerator urinae. Hence you learn that it is not possible to make your incision in the lateral operation for lithotomy, so as to avoid wounding some fibers of the erector penis or accelerator urinae. However, these muscles will only be wounded in the direction of their fibers, so that the capability of performing their respective offices will not be materially injured. Proceeding in the dissection, now remove the superficial fascia of the perineum, and then clear away some cellular substance covering the muscles, so as to give a distinct view of them. Next remove these muscles, taking care not to cut another fascia which lies under them, and which we shall presently examine, under the name of the anterior layer of the triangular ligament of the urethra, or membranous septum of the perineum.

The perineal muscles being removed, the bulb of the urethra is exposed to view. This, you observe, has its anterior part corresponding to the angle of the pubis, from which it extends backwards on the perineum, so as to reach nearly to the anus. In this course it gradually swells into that bulbous extremity which lies near to the rectum. Press the bulb of the urethra a little to one side with the handle of your knife, and then observe more accurately the attachment of this layer of the triangular ligament of the urethra. It is seen to fix itself to the anterior edge of the arch of the pubis, to continue its attachment to the rami of the ossa pubis, and to the rami of the ischia; the place of its attachment being behind that of the crura penis to the same bones. On this ligament we observe the bulb of the urethra to rest, and we shall find in the septum, a hole for transmitting the membranous part of this canal.

The following dissection will enable you to discover this opening, and to examine more satisfactorily the anterior layer of the triangular ligament of the urethra. Cut across the urethra at the distance of an inch anterior to the arch of the pubis. Separate it carefully from the corpora cavernosa penis, and turn it down on the perineum. In doing this, you must avoid cutting



the parts too close to the anterior surface of the symphysis pubis, lest you cut away the upper end of this ligament, in subjects where it is but thin and weak. By this proceeding, you discover that the edges of the opening for transmitting the urethra, are continued onwards upon the surface of this canal to a small distance. This attachment requires to be separated by the knife; for it is this which prevents us from seeing a regular well defined border to this opening. The bulb of the urethra does not lie loose and unconnected upon the surface of this ligament. On the contrary, you find it to be fixed in this place, and connected with the anterior surface of this ligament, by an attachment of an almost ligamentous nature; so that even the largest and most posterior part of the bulb, although it pass backward towards the anus, cannot be said to lie loose or pendulous in the perineum. Since then the membranous part of the urethra lies so much nearer to the arch of the pubis, while the bulb passes so far backward in the perineum towards the anus; and since our incisions in lithotomy, should begin at the seat of the membranous part of the urethra, it follows that we are in danger of wounding the bulb, as we carry our incision downwards between the tuber ischii and anus. As it is advisable that in lithotomy, our division of the urethra should commence on the membranous part; and as it will afford us much satisfaction to have our judgment of the depth at which this lies, guided by some certain rule, we should carefully study the depth at which the opening in the triangular ligament lies from the surface of the perineum.

We should also carefully observe the height at which the aperture in this ligament is situated. Mark that it is not immediately under the arch of the ossa pubis, but about an inch below it. A strong ligament occupies the space between this opening and the inferior edges of these bones.

This ligament, which may be called the pubic ligament, lies between the layers of the triangular ligament of the urethra. It is about half an inch deep, having its lower edge thick and perfectly straight. This ligament is of great strength, and thickness. Hence it is obvious that the membranous part of the urethra does not lie close to the lower edge of the symphysis pubis; its course is half an inch below this edge.

Very slight reflection will convince us that much difficulty must occur in making the catheter or sound enter into the anterior part of the membranous portion of this canal, as it is not only surrounded by the edges of the aperture in the triangular ligament, but also lies under the edge of the pubic ligament.

It is against this ligament, and not against the pubis, that the end of the catheter is pressed, when, in attempting to introduce it, the point of the instrument is turned upwards too early.

If in attempting to extract the stone, we should withdraw the forceps horizontally, this firm ligament will oppose a very considerable resistance to its extraction.

THE END



# On the Fracture of the Carpal Extremity of the Radius

BY

A. COLLES, M.D.

*One of the Professors of Anatomy and Surgery in the Royal College of Surgeons in Ireland  
Published in The Edinburgh Medical and Surgical Journal, 10: 182-186, 1814*



THE injury to which I wish to direct the attention of surgeons, has not, as far as I know, been described by any author; indeed, the form of the carpal extremity of the radius would rather incline us to question its being liable to fracture. The absence of crepitus and of other common symptoms of fracture, together with the swelling which instantly arises in this, as in other injuries of the wrist, render the difficulty of ascertaining the real nature of the case very considerable.

(p. 183) This fracture takes place at about an inch and a half above the carpal extremity of the radius, and exhibits the following appearances.

The posterior surface of the limb presents a considerable deformity; for a depression is seen in the forearm, about an inch and a half above the end of this bone, while a considerable swelling occupies the wrist and the metacarpus. Indeed the carpus and base of metacarpus appear to be thrown backward so much, as on first view to excite a suspicion that the carpus has been dislocated forward.

On viewing the anterior surface of the limb, we observe a considerable fulness, as if caused by the flexor tendons being thrown forwards. The fulness extends upwards to about one-third of the length of the fore-arm, and terminates below at the upper edge of the annular ligament of the wrist. The extremity of the

ulna is seen projecting towards the palm and inner edge of the limb; the degree, however, in which this projection takes place, is different in different instances.

If the surgeon proceed to investigate the nature of this injury, he will find that the end of the ulna admits of being readily moved backwards and forwards.

On the posterior surface, he will discover, by the touch, that the swelling on the wrist and metacarpus is not caused entirely by an effusion among the softer parts; he will perceive that the ends of the metacarpal, and second row of carpal bones, form no small part of it. This, strengthening the suspicion which the first view of the case had excited, leads him to examine, in a more particular manner, the anterior part of the joint; but the want of that solid resistance, which a dislocation of the carpus forward must occasion, forces him to abandon this notion, and leaves him in a state of perplexing uncertainty as to the real nature of injury. He will therefore endeavour to gain some information, by examining the bones of the fore-arm. The facility with which (as was before noticed) the ulna can be moved backward and forward, does not furnish him with any useful hint. When he moves his fingers along the anterior surface of the radius, he finds it more full and prominent than is natural; a similar examination of the posterior surface of this bone, induces him to think that a depression is felt about an inch and a half above its carpal extremity. He now expects to find satisfactory proofs of a fracture of the radius at this spot. For this purpose, he attempts to move the broken pieces of the bone in opposite directions; but, although the patient is by this examination subjected to considerable pain, yet, neither crepitus nor a yielding of the bone at the seat of fracture, nor any other positive evidence (apart from the existence of such an injury) is thereby obtained. The patient complains of severe pain as often as an attempt is made to move to the limb the motions of pronation and supination.

If the surgeon lock his hand in that of the patient's, and make extension, even with a moderate force, he restores the bone to its natural form; but the distortion of the limb instantly returns, as the extension being removed. Should the difficulty persist, the

a moderate extension restores the limb to its form, induce the practitioner to treat this as a case of sprain, he will find, after a lapse of time sufficient for the removal of similar swellings, the deformity undiminished. Or, should he mistake the case for a dislocation of the wrist, and attempt to retain the parts in situ by tight bandages and splints, the pain caused by the pressure on the back of the wrist will force him to unbind them in a few hours; and, if they be applied more loosely, he will find, at the expiration of a few weeks, that the deformity still exists in its fullest extent, and that it is now no longer to be removed by making extension of the limb. By such mistakes the patient is doomed to endure for many months considerable lameness and stiffness of the limb, accompanied by severe pains on attempting to bend the hand and fingers. One consolation only remains, that the limb will at some remote period again enjoy perfect freedom in all its motions and be completely exempt from pain; the deformity, however, will remain undiminished through life.

The unfavorable result of some of the first cases of this description which came under my care, forced me to investigate with peculiar anxiety the nature of the injury. But while the absence of crepitus and of the other usual symptoms of fracture rendered the diagnosis extremely difficult, a recollection of the superior strength and thickness of this part of the radius, joined to the mobility of its articulation with the carpus and ulna, rather inclined me to question the possibility of a fracture taking place at this part of the bone. At last, after many unsuccessful trials, I hit upon the following simple method of examination, by which I was enabled to ascertain, that the symptoms above enumerated actually arose from a fracture, seated about an inch and a half above the carpal extremity of the radius.

Let the surgeon apply the fingers of one hand to the seat of the suspected fracture, and, locking the other hand in that of the patient, make a moderate extension, until he observes the limb restored to its natural form. As soon as this is effected, let him move the patient's hand backward and forward; and he will, at every such attempt, be sensible of a yielding of the fractured ends of the bone, and this to such a degree as must remove all doubt from his mind.

The nature of this injury once ascertained, it will be a very easy matter to explain the different phenomena attendant on it, and to point out a method of treatment which will prove completely successful. The hard swelling which appears on the back of the hand, is caused by the carpal surface of the radius being directed slightly backwards instead of looking directly downwards. The carpus and metacarpus, retaining their connections with this bone, must follow it in its derangements, and cause the convexity above alluded to. This change of direction in the articulating surface of the radius is caused by the tendons of the extensor muscles of the thumb, which pass along the posterior surface of the radius in sheaths firmly connected with the inferior extremity of this bone. The broken extremity of the radius being thus drawn backwards, causes the ulna to appear prominent toward the palmar surface, while it is possibly thrown more towards the inner or ulnar side of the limb, by the upper end of the fragment of the radius pressing against it in that direction. The separation of these two bones from each other is facilitated by a previous rupture of their capsular ligament; an event which may readily be occasioned by the violence of the injury. An effusion into the sheaths of the flexor tendons will account for that swelling which occupies the limb anteriorly.

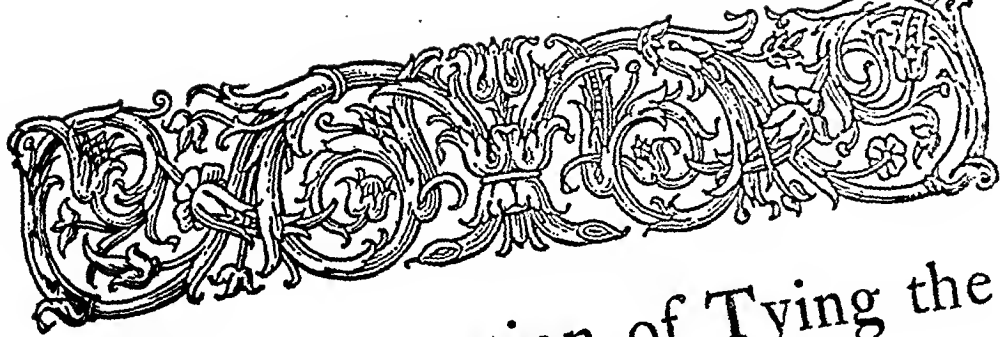
It is obvious that, in the treatment of this fracture, our attention should be principally directed to guard against the carpal end of the radius being drawn backwards. For this purpose, while assistants hold the limb in a middle state between pronation and supination, let a thick and firm compress be applied transversely on the anterior surface of the limb, at the seat of fracture, taking care that it shall not press on the ulna; let this be bound on firmly with a roller, and then let a tin splint, formed to the shape of the arm, be applied to both its anterior and posterior surfaces. In cases where the end of the ulna has appeared much displaced, I have laid a very narrow wooden splint along the naked side of this bone. This latter splint, I now think, should be used in every instance, as, by pressing the extremity of the ulna against the side of the radius, it will tend to oppose the displacement of the fractured end of this bone. It is scarcely necessary to ob-

serve, that the two principal splints should be much more narrow at the wrist than those in general use, and should also extend to the roots of the fingers, spreading out so as to give a firm support to the hand. The cases treated on this plan have all recovered without the smallest defect or deformity of the limb, in the ordinary time for the cure of fractures.

I cannot conclude these observations without remarking, that were my opinion to be drawn from these cases only which have occurred to me, I should consider this as by far the most common injury to which the wrist or carpal extremities of the radius and ulna are exposed. During the last three years I have not met with a single instance of Dessault's dislocation of the inferior end of the radius, while I have had opportunities of seeing a vast number of the fracture of the lower end of this bone.

"Stephens Green, February 21, 1814."

THE END

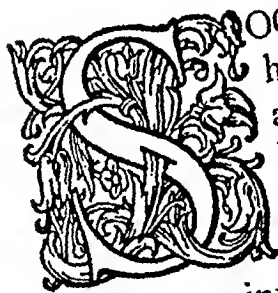


# On the Operation of Tying the Subclavian Artery

BY

ABRAHAM COLLES

Published in The Edinburgh Medical and Surgical Journal, 11: 1-25, 1815  
Herein reprinted from *Selections from the works of Abraham Colles*. Edited by  
Robert McDonnell. London, New Sydenham Society, 1881. pp. 337-366



SOON after I had been raised to the office I now hold in the College of Surgeons, I turned my attention to the study of the subclavian artery. My first object was to discover the most effectual means of compressing the artery, and to ascertain the most eligible spot for this purpose; my next, to investigate the practicability of tying this artery either before it reaches or after it has passed through the scaleni muscles. The anatomy of the parts satisfied me of the feasibility of the operation; and Mr. John Bell's luminous statement and lively description of the anastomosing arteries situated about the joint encouraged me to hope for its final success. Still, however, I did not feel myself justified in stating my opinion to the pupils of the college, for as yet the operation had not only been untried in practice, but the proposal wanted even the sanction of analogy. At length Mr. Abernethy gave to the world the first account of his operation of tying the external iliac artery. From this moment I felt myself authorised openly to express my sentiments and every year since I have taken occasion, both in the anatomical and surgical course, not only to state to the class my sentiments generally on this subject, but to point out to them particularly



the manner in which I conceived the operation might be performed.

A case of axillary aneurism having, in the year 1809, come under my care in the hospital, I proposed this operation, on which I had so long meditated, to the other surgeons in consultation. The proposal, however, was overruled, chiefly on the grounds of the operation never having been performed; and I confess that I yielded to the voice of the majority with the less reluctance, because I felt a secret apprehension of some terrible revolution being produced in the frame by tying an artery of such magnitude so close to the heart. This patient, in a few months, fell a victim to the disease; but neither by argument, nor influence, nor stratagem, could I obtain an opportunity of examining the body. Mr. Ramsden now published his account of the operation which he performed on this artery after its passage through the scaleni. Although the result was finally unsuccessful, the experiment served at least to prove to me one point incontestably, namely, that the fear of immediate danger from a general revulsion in the system was totally groundless. Emboldened by the establishment of this fact I again proposed the operation in the very next case that occurred, and it was unanimously agreed to in consultation. In this case I undertook to tie the artery before it had yet reached the scaleni. Several months elapsed before another case presented itself; but the patient in this instance positively refused to submit to the operation unless I would assure him of complete success. The unshaken fortitude and patient resignation with which he submitted to the wide-spreading ravages of this painful disease through all its successive stages proved that, in this determination, he was not influenced by a desire to avoid the comparatively trifling pain of an operation. Of this case I have related the appearances on dissection, as I think they suggest some useful practical inferences.

The third case was, of all, the most favourable for operation, and yet the result proved unfortunate. In this the artery was tied after it had passed through the scaleni.

Case 1.—Michael Cowel, a labourer, aged 33 years, was admitted into Dr. Steevens's hospital on 23rd September, 1811,

for an aneurism of the right subclavian artery. He gave the following account of his disease:—

Thinks that he repeatedly hurt himself by endeavouring to push on with his shoulder a loaded car, the wheels of which had sunk deep in passing over heavy ground. Soon after these exertions (perhaps in the course of a week) he began to complain at and near to the clavicle. At this time too he felt a tumour the size of a cherry, which throbbed with a continual pulsation. He points out a spot above the middle of the clavicle, and rather towards its humeral extremity, as having been the original seat of the disease. He did, in this early stage of the disease, observe a tumour or pulsation in a spot nearer to the sternum, but says that as the tumour increased in size it extended itself in that direction. It was not until the beginning of July he first felt a pain and numbness along the right arm and forearm.

At present the tumour extends from the sternal origin of the sterno-mastoid muscle along the clavicle, until it reaches a little beyond the arch of that bone. It rises in height nearly two inches above the clavicle, and is of a conical form, the apex of the cone being situated at the outer edge of the sterno-mastoid muscle. The finger can be passed with facility between the clavicle and tumour, but at no part can it be passed between the posterior surface of the tumour and the subjacent parts. The aneurismal pulsation is less strong, and the tumour more compressible between the heads of the sterno-mastoid muscle than at any other part. Pulse 74, and of nearly equal strength in both wrists. Of late he complains of slight numbness in the fingers of his right hand. He speaks of some uneasiness in the chest, which he terms "a draw on his chest." This has been much relieved since yesterday by blood-letting at the arm to the amount of fourteen ounces. His health in every other respect is good.

On Thursday, October 10th, the operation was performed, the patient being laid on his back upon a table, so placed that the direct light fell on the right side of his neck.

Two incisions were made through the integuments; the first running along the middle of the sterno-mastoid muscle, from the highest point of the aneurism to the top of the thorax; the second beginning at the middle height of the first, and ending at the

sternal articulation of the clavicle. The integuments being then separated from the subjacent parts, the lower triangular flap of skin was laid down on the thorax, and the upper portion turned upon the side of the throat. The mastoid muscle being thus exposed to view, its different portions were next divided. The sternal portion was first cut through about an inch and a half above its origin. This was done with a sharp-pointed bistoury passed on a director which had been introduced on the outer edge of the muscle. The clavicular portion was then divided to the breadth of about half an inch, the director being passed on its inner edge. In both these cases the introduction of the director was much facilitated by slightly scraping along the edge of the muscle. The lower divisions of the muscle were then dissected from the subjacent parts and turned down over the clavicle. Now the line of the carotid artery could be distinguished, and its pulsations felt by the finger. The sterno-thyroid and hyoid muscles lying exposed, were divided in the same manner, and at the same height from the clavicle as the sterno-mastoid had been. The division was carried only through so much of their breadth as enabled us fully to expose the carotid artery. We then proceeded to detach the lower divisions of these muscles from the surrounding parts; but here some delay was occasioned by a large vein descending from the anterior part of the throat into the internal jugular. The vein, however, being secured by two ligatures applied at a small distance from each other, and then divided in the interval between them, the inferior portions of the sterno-thyroid and hyoid muscles were raised from their beds and turned down on the thorax. Now the sheath of the carotid artery was opened by pinching up a small portion of it with the forceps and cutting the raised part with the knife, carried horizontally. The director, introduced at this opening, was passed down towards the thorax, and on it the sheath of this vessel, near to its root, was divided.

During this and all the subsequent steps of the operation the internal jugular vein was removed beyond the reach of the knife by an assistant, who, with a flat silver instrument, not unlike a powder-knife bended at the point, drew it outwards and held it aside.

When the sheath of the carotid artery was divided the eighth pair of nerves became visible; it lay deep, and to the outside, nearer to the carotid as they descended towards the thorax. An instrument, similar to that above described, but of larger dimensions and greater curvature, was now employed to protect this nerve, together with the internal jugular vein. The interval between the carotid and the eighth pair of nerves in the vicinity of the thorax was now scratched a good deal by cautious touches of the knife, for the purpose of obtaining a view of the origin and course of the subclavian artery. And now it was found that the aneurismal tumour had extended so close to the trunk of the carotid as to leave it uncertain whether any portion of the subclavian artery was free from the disease. Indeed, so strongly were the assistants impressed with the apprehension that the aneurismal tumour had extended to the aorta, or right common trunk, that the majority appeared disposed to abandon the operation altogether. Supported, however, by the concurrence of Mr. Wilmot, I determined to persevere in the attempt, at least till we could positively ascertain the actual state of the artery. I therefore proceeded to lay open that portion of the sheath which invests the very root of the carotid, in effecting which a small artery was cut close to the coats of the carotid, and yielded a smart haemorrhage. Some attempts were made to secure it with a ligature, but these only served to impress us with the idea that some irregular and nameless branch of the carotid had been cut so close to its origin that it could not be tied. Our uneasiness, however, on this head was soon at an end, for the bleeding spontaneously ceased. The division of the sheath being completed, we could now see that only a small portion of the subclavian artery, lying between the aneurism and the forking of the *arteria inominata*, remained in a sound state. The length of this sound portion did not exceed a quarter of an inch, and on this we resolved to apply the ligature. For this purpose I endeavoured, with the point and nail of my fore-finger, and occasionally with the flat handle of a silver director, to separate the artery and adjoining portion of the aneurismal tumour from the parts in their vicinity. This was not accomplished without considerable diffi-

culty and delay. But these disadvantages appeared to me of little consequence in comparison with the danger that might attend the use of the knife in this critical step of the operation. When the artery seemed to be sufficiently detached I took an aneurism needle of softened silver, blunt at the point and longer than those in common use, armed with a ligature of six silk threads, and, guiding it with my left fore-finger, passed it down on the inferior or thoracic side of the artery. But I could not push it upwards, so as to pass its point with safety beyond the cervical side of the vessel.

I then detached the artery still more completely from the surrounding parts, and again made repeated trials to pass the ligature, not only with the needle above described, but with the common aneurism-needle, and also with a loop of softened silver wire, but all without effect.

All these instruments had been introduced from below upwards with the view of guarding against the danger of wounding the pleura.

It was now proposed to try whether the artery might not be surrounded by passing the needle in the contrary direction. And with this advice I complied, rather indeed because I had been so long and so repeatedly foiled in my former attempts than because the danger of the proposed plan had escaped by recollection. With the same instruments, therefore, I made a few efforts to pass the ligature in the manner recommended, in some of which I had reason to fear that the pleura was wounded, both from the increased difficulty of respiration and from the bubbling of the air among the blood. I soon found it still more impracticable to pass the ligature in this than in the former direction. Different plans for passing the ligature were now suggested by the assistants. Among these, one was to tie one end of the ligature into a knot sufficiently large to prevent it from slipping through the eye, and then, with a sharp hook or pair of spring-forceps, to lay hold of the knot when carried in on the concave side of the needle. I made the attempt, but the eye was so long that it allowed the knot to remain behind the vessel when the needle was pushed forward, in consequence of which this expedi-

ent failed. After all these trials the ligature was at length passed with a common silver aneurism-needle, introduced from the thorax upwards. But it was necessary to use a good deal of force on the occasion, so that the artery was raised up considerably out of its natural situation.

I now put a single knot on the ligature, and ventured to tighten it in the following manner:—I took a polypus-forceps, the blades of which had been made fast, with an interval left between them wide enough to receive the artery. I then passed one end of the ligature through each eye of the forceps, and, holding in each hand a blade of the forceps and an end of the ligature, I pushed the points of the forceps down on each side of the artery. By this means the ends of the ligature, which crossed each other on the surface of the artery, were drawn in opposite directions, and the knot was thus gradually tightened.

The pulsation in the tumour and in the radial artery was now considerably weakened, but not totally suppressed. Prior to tightening the noose the breathing of the patient had become more laboured, and he complained much of an oppression at his heart. On tightening the ligature these symptoms increased to such a pitch that every one present apprehended his immediate death. He was raised up and supported in a sitting posture, but without affording him any relief; his countenance grew pale and indicative of instant dissolution. Yet his pulse did not become intermitting, or in any manner irregular, as was observed by a gentleman, who, during these awful moments, kept his finger applied to the right wrist. In this alarming state he continued for the space of about a minute, during which some of the assistants were so strongly impressed with the idea of his danger that they quitted the room, lest he should expire before their eyes. During these struggles the polypus-forceps were withdrawn, and, as the ligature had been tied with only a single knot, it is to be presumed that it yielded to the pulsations of the artery. Yet the patient did not appear to be at all relieved. Indeed, so great was his distress, and so strong my fears, that I had actually passed the index finger of my left hand along one side of the ligature, down to the noose, and was just about to cut through it:

with a probe-pointed bistoury; but, perceiving at this moment that his distress was a little relieved, the idea occurred to me that the wound of the pleura had been the principal cause of his sufferings. I now closed the lips of the wound, and this procured him immediate and sensible relief. However, the patient was so exhausted by this painful and tedious operation, and had suffered so much on the tightening of the ligature, that all present agreed to leave the ligature in its place, and to wait the issue of a few hours or a few days. It was conceived that by thus allowing time for the wound in the pleura to be consolidated the operation might hereafter be completed, as in that case, the right lung being capable of performing its office, the heart would labour less when this ligature was again tightened. Accordingly the lips of the wound were brought into close contact by three stitches of interrupted suture passed through the integuments. The patient was laid in bed and supported in a sitting posture, being incapable of lying horizontally.

Thursday evening, 8 o'clock.—Pulse 96, full, regular, and equal in both arms. After the operation he had been unable to swallow any fluid, except by sucking a bit of linen wetted with his drink. Within the last two hours has been able to swallow better, but still only a small sup at a time. Complains only of his heart; said that it feels as if a knot were tied in it, yet points to the scrobiculus cordis as the seat of his distress. Countenance rather flushed; skin moist; temperature of both hands equal. Sixteen ounces of blood being now drawn from his arm procured him some relief.

Friday morning, 8 o'clock.—Did not sleep one moment during the night, yet says he passed it very well; his sister, who sat with him, says that he had a great many catchings at his heart. What she means by this term it is impossible for me to ascertain, as I have not seen him affected in the manner she attempts to describe. The blood drawn last night is very buffy, and much cupped: pulse this morning 120.

at 12 o'clock.—Pulse 116; distress rather less. It was determined that he should be bled again, but he was advised not to have the blood drawn till his distress should increase.

8 o'clock p.m.—He himself desired to be blooded, and sixteen ounces were taken from him at 9 o'clock. He declared himself much relieved by the bleeding; pulse only 96.

Saturday morning, 8 o'clock.—Has had some short slumbers during the night; lies much more flat and horizontal; swallows more freely, and takes large sups of his drink, swallowing it gradually; pulse 108, regular and equal in both wrists. He thinks himself much better, but still complains of his heart. No palpitation or fluttering of the heart can be felt when the hand is applied to the thorax.

Saturday evening, 9 o'clock.—Pulse 96, as he lies without speaking; when he speaks it increases to 110. He has eaten a small quantity of boiled bread and milk, and a little cake steeped in tea; thinks himself much better.

Sunday morning.—Pulse 108; has enjoyed better sleep last night; has lain on the left side for an hour, and now lies with his head less raised.

Sunday evening.—Has eaten boiled bread and milk in the day and some flummery in the evening; lies now with his head very little raised, and has lain on both sides at different times this day. Pulse 130 and small; complains of some pain in the wound; tongue is white; countenance rather flushed; no stool since the operation.—Enema purgans statim.

Monday, 12 o'clock.—He rested pretty well last night, and feels refreshed this morning; breathing free; he lies horizontally, and on his right side; pulse 114. The enema has procured a very copious evacuation; thirst has been relieved by taking lemon juice in his barley-water.

In the interval between our first seeing him and visiting the rest of the hospital he was seized with a shivering which lasted for ten minutes. During the shivering his skin did not feel cold to the hand, nor had he himself any sensation of chillness, but said that the shivering would go off directly. He got a little warm wine and fifteen drops of tincture of opium. His pulse and breathing seemed not at all affected by this rigour. In half an hour after the rigour had ceased we proceeded to dress him; the lips of the wound appeared nearly united; a very small quantity



only of thin discharge had flowed along the ligature. It was now deemed advisable to cut out the two lowest sutures of the integuments, and to separate the lips of the wound, for, in the present stage of the wound, this could be easily effected, whereas, if it were deferred for one or two days more, it would possibly require the use of the knife. Accordingly the sutures were cut out, and the lips of the wound separated by drawing the flat part of an eyed probe along the line of the wound. The knot of the ligature could not be felt at such a distance from the artery that we thought that the point of the fore-finger could just be insinuated a little between them. A consultation was now held to decide on the propriety of immediately proceeding to tie the ligature. Some proposed that it should be altogether withdrawn; others recommended that the attempt of tying it should be made, but to postpone it for a day or two, till the effects of the rigour should have shown themselves; while a third opinion urged the necessity of either instantly withdrawing the ligature, or tying it closely on the artery,—these last assigning, as the grounds of their opinion, the danger that the ligature, lying in contact with the artery, should so far produce ulceration of its coats that they would tear under the ligature if attempted to be tightened in one or two days hence; that the rigour had ceased, and the functions of circulation and respiration were going on perfectly well at this moment; in short, that the present moment was as favourable as any future period could be. The latter opinion prevailed, and the third or uppermost suture being cut out, and the wound thrown open, I proceeded to untie the remaining single knot. My object in doing this was to include in the noose along with the artery a bit of flexible silver wire, for the purpose of enabling us more readily to cut out the ligature if we found, on tightening it, that alarming symptoms would be induced; another reason was that we might tie on it the surgeon's knot, which would not slip, whereas with the single knot the ligature could scarcely be tied tightly at the bottom of such a very deep cavity. Without much difficulty the knot was untied, a probe and aneurism-needle having been successively used for the purpose of widening the noose. The wire, very much bent, was included in the new

noose, on which was formed the surgeon's knot; the ends of the ligature were passed, each through the eye, on the end of an iron wire; these were thrust down, as I then fancied, to the bottom of the wound, and attempts made to tighten the ligature, but to very little purpose. Now, fearing that the wire somehow prevented the ligature from being tightened, one end of it was cut off close to the surface of the wound, and the wire was then withdrawn by using a slight force. Now, passing my finger down to ascertain the state of the ligature, I discovered that we had not arrived at the bottom of the wound; the wires had descended only to the neighbourhood of the anterior surface of the vessel. I now separated, with my finger, the recent attachments of the artery to the surrounding parts, and, passing each end of the ligature through the eye of a polypus-forceps, the blades of which had been previously taken asunder, I passed these down to the bottom of the wound, and, giving the upper one to Mr. Wilmot to hold, I held the lower one myself, and at the same time drew it very tightly. This attempt reduced the strength of pulsation both in the tumour and at the wrists; but we found that this effect was owing, in a good measure, to the artery being raised forward, and to the influence which pressing down the blades of the forceps had on rendering it more tight. The reason why I held the blade nearer to the thorax was, that I feared if it had been directed downwards the pleura must almost inevitably have been again lacerated. I next made the attempt, having only the upper end of the ligature passed through one blade of the forceps, while the lower, which, from being short and wet, could not be held firm by the fingers, was rolled round the other blade, while the fore-finger of my right hand was employed in giving a favourable direction to the ligature, so as to prevent its raising the artery up out of its situation. After one or two attempts in this way the closing of the artery was effected, as was manifested by the pulsation of the radial artery completely ceasing. Some slight obscure pulsation, however, was still to be felt in the tumour, which led some present to apprehend that the ligature was not drawn sufficiently tight; but on a moment's reflection it occurred to us that this degree of pulsation was con-

municated to the tumour by the pulsation of the sound part of the artery. A small quantity of florid blood flowed from a deep part of the wound, but not in a stream, just as the ligature was tied. A second knot was now made, and the wound closed by two points of interrupted suture.

During the tying of the ligature no alteration was observable in his countenance, respiration, or the actions of his heart. An assistant, who had held his hand on the left radial artery during the tying, could not discover the slightest alteration to have been induced by it; the patient did not exhibit the slightest symptom of pain; in fact, he seemed not to suffer in the slightest degree from this sudden revolution effected in the arterial system; he moved the arm as freely as ever.

I saw him an hour after the operation, at which time the temperature of both hands was equal, being in both 91 degrees. He continued free from any uneasiness. He had drunk very largely of whey during the operation, which lasted one hour; his thirst at this time continues unabated; he wishes for lemonade.

8 o'clock p.m., Monday.—Pulse 120; temperature of both arms, 91 degrees; thirst continues; has not had any sleep; tongue white and dry; skin moist, and feels of the natural warmth; he did not use any food since the operation this day.

Tuesday morning, 8 o'clock.—Pulse 130; in half an hour after, 120; passed the night without sleep, and has had very great thirst; yet he thinks himself better. He wishes for a few morsels of broiled meat, rather to indulge a medical theory than to gratify his appetite, for his stomach and bowels are extremely flatulent, which, he fancies, arises from want of solid food. Tongue is white; thirst is now less urgent; temperature of both arms equal.—*Habeat haust. efferves, tertiis horis.*

Tuesday evening, 9 o'clock.—He has just fallen asleep, and is talking almost incessantly, is tossing his limbs about, and would appear to suffer great distress; yet his sister says that this is not different from what occurs to him when in health; for that when he first falls asleep he talks over the occurrences of the past day, and tosses himself about in the bed, but that after he has been asleep for some time his repose becomes quiet and profound.

Pulse, 120; temperature of both arms apparently the same: has had some sleep during the day, and thinks he might have had more had he not wished to reserve it for the night; thirst is very inconsiderable since morning; ate some flummery; tongue more clean.

Wednesday morning, 8 o'clock.—He has been just disturbed from a short sleep, and appears rather confused; has passed a good night, but thinks himself weaker this morning. Pulse 120, smaller and weaker; thirst not more urgent; complains of the fetor of the discharge from the wound, and wishes it to be dressed. A considerable quantity of a yellow serous fluid came from the lowest point of the wound; part of it flowed spontaneously, and some escaped when pressure was applied to the more remoted parts of the wound. The skin did not adhere to the subjacent parts; a small quantity of air seemed to be interposed. No pulsation is felt in the tumour on the humeral side of the longitudinal incision of the neck. He appeared a good deal fatigued after the dressing. Tongue white.—*Habeat pil. purg. unam statim, et post horas tres, enema purgans, nisi prius alvus soluta sit.*

Wednesday, 3 o'clock p.m.—Has had some refreshing sleep, and for a much greater length of time than heretofore: has eaten five or six morsels of beef-steak, and, lately, a little flummery; one copious stool after the injection. The nurse reports that a small quantity of blood came off with the stool, not more than was sufficient to streak it. He is now in a quiet sleep, lying on his left side.

Wednesday evening, 9 o'clock.—Has got still more sleep: temperature of the right hand, by the thermometer this day, 92; of the left hand, 92; but the right has been a good deal exposed to the cold, being very seldom kept under the bed-clothes; pulse 120. A few minutes before this visit a shivering had come on, which still continues; yet he does not experience the sensation of coldness, nor does his skin feel cold to the hand. His breathing now appears a little hurried, as he lies on the right side; yet, when desired to make a full forced respiration, he does not experience any pain from it, except what he refers to the heart, or *sternum cordis*, and this only in a trifling degree.

Thursday morning.—The rigour did not continue half an hour; he passed a good night; had one sleep for three hours, and during the rest of the night had a considerable share of sleep. Pulse 120, rather small; tossing of the lower extremities rather increased; thirst much less; discharge from the wound copious, but has passed off; none of it has lodged. On pressing with the sponge an unusual quantity of air escaped from under the skin; no emphysema noticed in the vicinity of the wound. An obscure pulsation in the tumour was either felt or fancied by me; certainly none can be felt at the wrist; size of the tumour a good deal reduced.

Thursday evening.—Has slept well this day; has eaten more flummery than on any former day; a slight emphysema in the lower and anterior part of the neck. At five o'clock this evening some blood had been observed on his shirt and on the bandages; yet in every respect he appears as well as usual. At 7 o'clock p.m. the dressings were removed, and the sutures cut out. On raising the flap of skin a small quantity of coagulated blood was found in the wound, though not in its deepest part; emphysema increased; obscure pulsation continues to be felt in the tumour. Three small pieces of sponge were laid in the wound; a larger piece was laid on the skin, and retained by adhesive plaster, as pressure could not be applied by a bandage without confining the thorax too much. Pulse 120; stomach moist; tongue white; temperature of limb and state of breathing as this morning.

Friday morning.—At 8 o'clock a.m. I received, from one of my pupils, the following note:—"About one o'clock last night this poor fellow got a change for the worse; appeared as if strangling, with continued tossing of his legs and arms; complained of his heart, and said there was some one pulling a cord round his neck. He became quite delirious; continued in this state for nearly half an hour, after which he got comparatively easy; and has been almost ever since insensible, and is at present, I think, very near his end."

I visited him at 9 o'clock this morning. He lay insensible, rather pale, but not of that deadly paleness which so often attends

great hæmorrhages; his breathing very laboured; in short, with every appearance of immediate death.

About 10 o'clock this morning he died.

In a few hours after his death we hastily removed the heart and large vessels, so low down as the clavicle, being prevented by the attendance of his friends from examining the parts *in situ*. No blood was effused into either cavity of the thorax. The lungs of both sides were sound; the upper extremity of the right lung had a slight adhesion with the parts in the vicinity of the ligature. The aorta was slit up from the heart to the forking of the arteria inominata; and thus we had an opportunity of observing the very diseased condition of the coats of this artery, as manifested by the wrinkled state of its lining membrane. A very remarkable pouch or recess, capable of receiving the point of the little finger, appeared in the wall of the aorta, on the right side of the artery, about one inch above the heart.

In the apex of this dilatation the coats of the artery were extremely thin, as if, the middle coat having been removed by absorption, the lining and outer coats had adhered together. The arteria inominata was dilated at the plate of its forking. Between this dilatation and the aneurism, for which the operation had been performed, there was not above a quarter of an inch of subclavian artery free from disease, and on this part the ligature had been applied. A pretty large opening had been made by ulceration through the coats of the artery, immediately above the ligature.

The next case of disease requiring the operation of tying the subclavian artery occurred in William Levance, an invalided soldier, who was affected with aneurism of the axillary artery a little below the clavicle. The disease seemed to have arisen spontaneously. Tumour was the size of a pullet's egg at the time of his applying for relief.

In full consultation the operation was decided on; but this patient refused to submit to it unless we assured him of complete recovery. He lingered for some months, and appeared to die, but it was not so.

orrhage, but rather from extensive suppuration and long-continued irritation.

*Appearances on Dissecting the body of William Levanee, aetat 55 years*

26th April, 1813.—Very considerable swelling occupied the right side of the body, extending from the clavicle down to the eighth rib, and from the nipple of the breast across the arm. The arm and fore-arm were very much distended by an oedematous swelling. Three large ulcers a little below and before the axilla; inferior costa of the scapula rough on its internal surface; the inferior angle of this bone exposed and rough. On opening the thorax the viscera were found perfectly healthy, with the exception of slight adhesions of the right lung to the pleura costalis, and some water in that side of the chest. Heart rather small, but appeared perfectly healthy. Large arteries near the heart not at all dilated, and no other traces of disease in any of them than some very small opaque spots visible on their internal coats.

The pectoralis major was of a pale brown colour, and much thinner than natural; the pectoralis minor converted into a substance resembling a strong fascia. The parts above the clavicle were still in a healthy state; the different steps of the operation for tying the subclavian artery before it had reached the scaleni were performed on it. The trunk of this artery was traced of natural size and healthy texture, for an inch and a half below the origin of the vertebrae, and running over the front of the aneurismal tumour. At this place its coats became so thin that it was no longer possible to distinguish them from the coats of the tumour. Immediately before it became indistinct this part of the artery seemed dilated to the breadth of a quarter of an inch. The articulation of the humerus was opened and communicated with the aneurismal tumour. The branches of the subclavian artery did not appear at all enlarged. The basilic vein was thickened in its coats, but not at all enlarged in its diameter.

On the 19th June, 1813, I was consulted by the Rev. Mr. S., aged 48. He was a man of an uncommonly athletic frame; had constantly enjoyed the most robust health, and had always lived a regular and temperate life. The account he gave of his complaint was as follows:—One night before Christmas last, while lying in bed, his right arm was suddenly seized with a numbness, and the right hand felt as if instantaneously enlarged to twice its natural size. Soon after this the middle of the forearm and the insertion of the deltoid muscle were attacked with pains. He said that the physician whom he had consulted in the country had remarked, with some surprise, that he could not feel any pulse at the wrist of the arm affected. The disease passed for rheumatism until he came up to Dublin; but, on his arrival in town, having applied to Dr. Harty to be electrified, the doctor, during the process, observed a portion of the chain, which happened to lie on Mr. S.'s breast, to be moved up and down by a violent pulsation of some subjacent part. Struck with this occurrence, he proceeded to examine the seat and cause of the phenomenon, when he discovered an aneurismal tumour situated below the clavicle, and covered by the pectoral muscle.

On the day following I saw him, and found the aneurism nearly of the size of a goose egg. The tumour pulsated strongly, but seemed notwithstanding to be both deeply seated and thickly covered. The pulse of the right radial artery was as full and strong as that of the left. By pressing with my thumb upon the diseased artery, above the clavicle, along the outside of the scalenus muscle, I suppressed the pulsation both in the tumour and at the wrist. But a strong pressure of the tumour itself, even when continued for some time, excited no uneasy sensation whatever, either in the region of the heart or in any other part of the thorax; nor did it affect the powers of respiration in the slightest degree. In short, nothing preternatural could be discovered in the actions either of the heart or of the arteries, or any possible variation of circumstances.

On this very important case I requested a full consultation without loss of time; and accordingly, next day Messrs. Keble, Peile, and Wilmot, Dr. Harty, and I met in consultation. It was



our unanimous opinion that, although the present disease could not be clearly traced to an accidental injury, yet, as not the slightest appearance of disease could be discovered in any other part of the arterial system, it was our duty to propose the operation of tying the subclavian artery.

Mr. S., who was a man of uncommon fortitude of mind, consented at once to submit to this formidable operation. He wished, however, first to return to the country for some days, in order to settle his affairs. To this delay we acceded, advising him to avoid all bodily exertions, to live on very low diet, and to debar himself of a full meal even of the coarsest fare. We also prescribed some strong purging pills, to be taken frequently, and directed that he should be bled twice at least before his return to Dublin.

On the 16th of July he returned, a good deal reduced in flesh and colour. The aneurism had increased in size during his absence, principally in the direction toward the clavicle. Indeed, to judge by the eye only, the tumour seemed to have extended to that bone; but by the touch it could be ascertained that the tumour and the clavicle were not yet in contact. He now told us that some of his friends in the country had reminded him of his horse having fallen and rolled over him a few days before he felt the numbness of the right hand; and he can now distinctly recollect that he suffered considerable pain about the shoulder at the time of the fall.

I commenced the operation by an incision beginning near to the acromion, and terminating about midway up the side of the neck. Another incision, commencing from the same point, was carried along the clavicle, until it reached the outer edge of the sterno-mastoid muscle; the triangular portion of integuments included between these incisions was raised up from its apex, and laid back upon the throat. In this first step of the operation some pains were taken to avoid wounding one or two pretty large veins which ran very superficially along the side of the neck. When the integuments were thus removed I detached the external jugular vein, at the highest point where it lay uncovered, and, with a blunt aneurism-needle, passed a ligature round it. I

next tied up, in the same way, a branch of this vein which entered the trunk a little above the clavicle, in a direction from the acromion; and I then secured the lower extremity of the denuded trunk of the jugular vein; but to effect this last was a task of more difficulty, for the vein here was not only covered by three or four layers of tough cellular substance and fat, but was besides, at times, suddenly puffed up to a very great size, especially whenever from pain the patient made a great exertion, accompanied with a deep and long-continued expiration. But notwithstanding all these ligatures the trunk of the vein was still freely supplied with blood from below, as appeared by its occasionally swelling in deep expirations. This obliged me to secure the trunk with a third ligature, about an inch above the clavicle, and, having done so, I cut the vein across between the two lowest ligatures, and laid the inferior portion of it down upon the clavicle. Now removing a little fat, I saw the omohyoid muscle covered with a fascia; it was of an uncommonly large size, and lay very low, near to the clavicle; it consequently became necessary to sacrifice it, in order to get at that part of the artery which lay near to the outer side of the scalenus muscle. For this purpose a very thin silver spatula was passed under the upper edge of the omohyoid muscle; with this it was raised a little from its bed, and was cut across. On removing this muscle a thin fascia appeared covering a deep bed of fat. Having cut through the fascia, I now, with the flat end of a silver director, cleared my way among the fat, until I could feel, though not see, the artery. As the vessel was now lying at the bottom of a deep contracted cavity, I judged it necessary to convert this into a more open and less embarrassing form of wound. This I did by cutting across the edge of the trapezius muscle and the numerous layers of membrane which occupied the space included between the deep cavity and the acromial end of the external wound. In effecting this one small artery was divided and secured by ligature. When the wound was thus enlarged, the most anterior of the nerves going to the brachial plexus appeared to view. I now proceeded to lay bare the artery, holding my finger down upon it, and turning aside the superincumbent fat with the flat end of a silver director.

But so great was the quantity of this substance to be removed, that, although I cut away three or four large pieces of fat with a scissors, and drew them out with a forceps, yet, to prevent the remainder from falling down again into the cavity upon the artery, I was obliged to have it held aside by three long and broad spatulas of prince's-metal, bended at the end, and applied one to each side of the wound. This materially facilitated the subsequent steps of the operation, by keeping the artery uninterruptedly exposed to view. My next object was to detach from the surrounding parts that portion of the artery which lay close to the scalenus muscle. To effect this I first made use of the flat end of the director, scraping with it along the outer or acromial side of the artery. I then ventured to separate it more completely by introducing a blunt aneurism-needle in the room of the director. This I moved upwards and downwards along the vessel until I was enabled to pass it freely under the artery, and to receive its point on the end of a narrow spatula, introduced between the vessel and the scalenus. Feeling the point of the needle on the spatula I was satisfied that it had cleared the artery. I now therefore depressed the handle. On doing so I observed that the point was covered by a dense white membranous substance, closely resembling the coats of an artery. I withdrew the needle, armed it with a double flat ligature (about six threads thick), and, again introducing it on the acromial side of the vessel, I quickly showed its point by the side of the scalenus, covered with the membranous substance as before. I hesitated for a moment, but every one present being satisfied that this substance was not a part of the vessel, I readily tore through it by scraping it with the flat end of the director. Now, merely by depressing the handle of the needle, without in the slightest degree raising the artery from its bed, I was enabled to catch the ligature on the inner side of the vessel. Having got a secure hold of it I withdrew the needle, leaving the ligature, doubled, under the artery. I then divided the ligature into two, and tied the lower with a single knot. Mr. Peile, who had applied one hand to the tumour and the other to the right radial artery, announced, as I tightened the ligature, that all pulsation had ceased in both.

The assistants, being all anxious to satisfy themselves of these facts, I let go the ligature. Although I let it out of my hands but for the few moments I was necessarily occupied in these inquiries, yet, even during this short period, the pulsation perfectly returned; I therefore again drew the ligature tight, the pulse in the limb ceased, and I quickly made fast the ligature with a double knot. To enable us to tie this knot we had no occasion for any instrument; nothing more was necessary than to catch the ends of the ligature close to the vessel, and then to press on them with the points of the fore-fingers, held on a level with the trunk of the artery. No other precaution was necessary to save it from being pulled up from its bed, in drawing the ends of the ligature tight. The unanimous voice of all present directed that the second or upper ligature should be tied, which was done, close to the first, with a double knot. In this awful and critical step of the operation I kept my eye firmly fixed upon the patient. His countenance did not undergo the slightest perceptible change. No alteration was observable in the actions of his heart, or in his respiration; nor did he experience any pain or particular sensation in the limb on the tying of the artery.

It should be observed that a large vein, which, in the dead subject, I had often found running across the artery, in a direction from the scapula towards the thorax, and which, I had feared, might be productive of much inconvenience on the present occasion, was here found to be flat and empty, and to run so near to the thorax as not to interfere in the smallest degree with the passing of the ligature.

When the operation was finished three stitches of interrupted suture, aided by adhesive plaster, kept the lips of the wound in contact; on the flap was laid a piece of dry sponge, to bring into apposition the upper and under walls of the cavity, which had been left after the operation.

Shortly after he had been laid in bed he complained of cold, but had no rigour. In the course of an hour he felt himself growing too hot. In three hours after the operation his pulse was 96. In this short period he forced me to change his position two or three times, from his back to his sides, to try if he could by this

means obtain any mitigation of what he termed a pain in the small of his back. He did not, however, complain of any pain or fulness in the head, or of any affection of the heart, or difficulty of breathing. His distress, though rather intense in degree, was of the same kind as I have frequently witnessed after amputation, or other great operations.

Mr. Wilmot, who remained with him from three o'clock this day until nine o'clock at night, informed me, on my return, that his pulse had got up so high that he had been almost tempted to bleed him; but a sweat breaking out, had reduced the pulse to its present state (120). For the remainder of the night I took charge of him, and during that time he was affected with a slight tossing of his lower limbs. He continued to complain of his back, and did not enjoy more than five or ten minutes' sleep at a time. He had some thirst, and in the course of the night his pulse rose to 134. He did not complain of the wound, except when he turned on that side or was awkwardly handled, and then he said it was sore. The sweat having at one time ceased for two hours, I observed that the right hand and arm became dry, as well as the left; and on the return of the sweat both arms were equally moist. The heat of both arms, too, appeared to be the same since the operation, and he has continued to enjoy the feelings and full power of the right hand.

Wednesday morning.—At six o'clock this morning I took twelve ounces of blood from his left arm; it flowed slowly, for he drew back his arm while I was making the incision. I gave him a draught, with two drachms of Aq. Ammon. Acetat.; and for a short time after this I fondly flattered myself that he became more easy and composed. These transient hopes, however, soon gave way to more gloomy apprehensions; and when I reflected on the quickness of his pulse, his restlessness and want of sleep, his forgetfulness and occasional wanderings of mind, I became greatly alarmed. I therefore summoned a consultation of all the gentlemen who had assisted me, for an earlier hour than that agreed upon the day before. We met at 11 o'clock a.m. His pulse was now 134, and the strokes ran so into one another that it was difficult to count them. The state of his pulse, we judged, would

not be improved by a repetition of the blood-letting. It was therefore agreed that he should be first purged, then take tincture of digitalis, and, if his restlessness required it, take an opiate at night.

Three o'clock p.m.—At this hour the physic had only operated once, and then very sparingly. His pulse was now driving at a rapid rate. He complained of an occasional cough, which distressed him so much that he was forced to entreat the attendant to keep one hand on his head and to grasp his left hand with the other whenever he felt a fit of it coming on. He complained also of a soreness in his throat when he coughed or swallowed; and he pointed to the middle of his throat as the seat of this affection. Although I suspected that his fears made him magnify his distress in this particular (for he apprehended that the inflammation, spreading from the wound to the throat, must quickly prove fatal), yet, when I recollected that my former patient Cowell had complained of the same sensation, I deemed it prudent to meet it early, and therefore instantly commenced with the digitalis, although his bowels had not been sufficiently freed by the purging medicines.

At 4 o'clock p.m. he got the first dose of 10 drops.

At 8 o'clock the second dose of 15 drops.

At 10 o'clock, 25 drops.

At 2 o'clock a.m. Thursday, 30 drops; and at 6 o'clock the same repeated.

By this medicine his pulse was reduced, so that at 10 o'clock p.m. it beat 120, but still with the same indistinctness as before.

Thursday morning, 6 o'clock.—The longest sleep he has had in the course of the night has not been above half an hour; the tossing of the lower limbs continues; they are dry, and, though covered with woollen stockings, are inclined to be cold. Countenance is natural, but more reduced than when in bed. Mental faculties more perfect than yesterday. Sweat continues on the head, trunk, and upper limbs. Has had many stools through the course of the night. State of tongue and throat as yesterday. Pulse 120, and indistinct. Means at present the same as he did the day before. Says that he has not slept so long

at the small of his back, but that it does not amount to pain. Thinks his throat better. There is some swelling, with a slight appearance of inflammation, across the top of the thorax. He now entertains better hopes of his recovery. He begins, however, to complain of some uneasiness in his chest, but says that it is relieved by sighing. The bandage, which feels rather too tight on the chest, is now cut across. Heat of right hand, measured by the thermometer, 94; that of the left hand, 96.

Thursday evening, 8 o'clock.—This day, at 1 o'clock p.m., he was suddenly seized with a rigour, which lasted for a quarter of an hour. This was succeeded by a profuse sweat. During the cold fit he talked much and incoherently. Soon after the hot fit commenced he started up, jumped out of bed, and became so violently outrageous that he required two strong men to hold him. In this state he continued for more than an hour. During this paroxysm he made the most powerful exertions with the right as well as with the left hand. After the paroxysm had subsided he enjoyed a sleep of half an hour, during which his breathing was natural. The cough, which had distressed him to such a degree yesterday, is so much relieved to-day as to cause only a slight and momentary uneasiness in his chest.

Thursday night, 10 o'clock.—He had been raving a good deal at 8 o'clock this evening, but at half-past nine he became quite collected, and inquired very anxiously about his own situation. Pulse more distinct, though not less frequent. Sweats continue. Some wheezing in his chest. Distress of that part less than it had been early in the evening. A large blister is applied to his chest.

The inflammatory fulness and redness of the skin at the top of the sternum and left side of the throat is considerably increased; the slightest pressure on this swelling gives him very sharp pain. Mr. Wilmot and I, conceiving it possible that his distress might be aggravated by some collection of matter confined or pent up within the wound, removed the dressings. Only a small quantity of reddish water was discharged. I then cut out one of the sutures, and passed a probe into the deepest part of the wound, conducting it along the ligature of the artery. We then made a

pressure on the inflamed integuments, at the top of the sternum and left side of the thorax, but without obtaining the smallest additional discharge. At this time the aneurismal swelling was in appearance quite removed, and both sides of the thorax were to the sight and touch perfectly alike.

Friday morning.—He passed the night without any sleep; raved a good deal, but was not violent. Purging more frequent. Has taken two doses of a mixture, each dose containing ss. Oxymel Scillae. Cough has not distressed him. He has expectorated some mucus. During the night he complained a good deal of the right fore-arm and hand,—at one time of numbness, and at another of pain. The hand is held with the fingers folded in, and rather stiffened. It now became too obvious that the storm, which had been collecting since the operation, had taken a fatal direction. The present state of the limb so strongly proved the near approach of mortification, that, however reluctantly, I was forced to relinquish every ray of hope, and to prepare my mind for the speedy termination of a case which I had watched with more fluctuations of hopes and fears than ever had agitated me on any former occasion.

Two o'clock p.m.—The fore-arm was distended at the insertion of the pronator teres, and also where the extensors of the thumb pass over the end of the radius; the hand and fore-arm cold; the fingers rigidly flexed. The usual applications were made to the limb, but without affording any relief. The mortification went on increasing; his delirium continued for the greater part of the night; and at four o'clock on Saturday morning he died.

## *Appearances on examining the body 26 hours after death.*

Suppuration was established under the integuments on the first part of the throat, anteriorly to the sterno-mastoid muscles. On the thorax being laid open we discovered an appearance of suppuration commencing on some masses of fat lying in the anterior mediastinum. The upper lobe of the right lung was attached to the ribs by close and old adhesions. Between three and four ounces of water found in the pericardium. The jugular veins, both the external and internal, were of a deeper



colour than usual. Heart felt rather soft; right auricle full; right ventricle less full than usual. No disease in any of the valves on either side of the heart. The internal surface of the right auricle, especially on the septum of the auricle, more red than usual. The redness, though of a brighter tinge than that of the jugular veins, was not such as to indicate the existence of inflammation of the cavity. The venous blood was more fluid than usual. Coagula were found in the right and left ventricles, but not uncommon either in their size or other properties.

On endeavouring to separate the aneurismal sac from the walls of the thorax, it was found to have connected itself so intimately with the second rib as to have its cavity laid open by an attempt to disunite them. The form of that portion of the bone upon which the aneurism rested was changed from a flat surface to a cupped form. The extent of the altered part of the second rib was about half an inch.

The aorta, with the great arteries springing from its arch, and the humeral artery, being removed from the body, were examined next day.

The aneurismal tumour had extended more in length than in breadth, and had ascended so high as to have reached near to the spot on which the ligature had been applied. The aneurismal tumour was nearly as large as a pullet's egg.

The artery immediately above the ligature was seen thrown into folds and furrows, which would seem to be the inevitable effect of tying an artery of so great a size. On removing the ligature, and slitting up the artery, its internal coat was found ruptured by the ligature only at one part, to the extent of about one-fourth of its circumference. Through the remainder of the circle the internal surface of the artery presented a white line, obviously produced by the tightening of the ligature. Two very small portions of coagulable lymph were found immediately above the ligature. The trunk of the artery below the ligature was rather small. The branches of the subclavian artery were not at all enlarged.

I have been (perhaps tediously) minute in detailing the particulars of the foregoing cases, because we have, as yet, but one

account published of the operation of tying the subclavian artery after it has passed through the scaleni muscles, and no instance, I believe, has hitherto been recorded in which this artery was tied before it had arrived at these muscles. Under such circumstances I would not presume to exercise my own judgment in omitting those particulars which to me did not seem important.

As I wished that every one who reads these accounts should be unbiassed in drawing his own inferences from the facts, I have studiously avoided any reflections of mine own. Such as have occurred to me in my attendance on these cases I shall now briefly state.

To lay bare the right subclavian artery before it reaches the scaleni will not be found difficult by any surgeon possessed of a steady hand and a competent knowledge of anatomy; but I fear that, with the utmost dexterity, much difficulty will be experienced in passing and tying the ligature, even in the most favourable cases. The instrument delineated in Mr. Ramsden's book appears to me well calculated for the purpose, and yet it is not free from objection. I shall fear that the coats of the artery might be cut by the sharp edges of the flexible steel plate as it is passing round the vessel. Some means similar to those I have mentioned must be adopted to prevent the artery from being raised out of its bed while the surgeon is tying the knot.

This operation, difficult on the right, must be deemed absolutely impracticable on the left subclavian artery. For the great depth from the surface at which this vessel is placed,—the direct course which it runs in ascending to the top of the pleura,—the sudden descent which it makes from this to sink under the protection of the clavicle, and the danger of including in the same ligature the eighth pair of nerves, the internal jugular vein, or the carotid artery, which all run close to and nearly parallel with this artery; these all constitute such a combination of difficulties as must deter the most enterprising surgeon from undertaking this operation on the left side.

Even on the right side this operation will be very seldom required; for it can only be called for in injuries or diseases of that small portion of this artery which lies between the scalenus and

the clavicle. It is scarcely necessary to observe here how frequently such a case will be complicated with diseases of the great trunks of the arteries nearer to the heart, or how difficult it must be to discover the existence of those internal affections. When examining any pulsating tumour near the top of the thorax, the surgeon should bear in recollection the remark made by Mr. Astley Cooper, as quoted by Mr. A. Burns, in his 'Surgical Anatomy of the Head and Neck,' "that aneurism of the aorta may assume the appearance of being seated in one of the arteries of the neck." The quantity of blood lost by the hæmorrhage, which yet we presume was the immediate cause of death in this case, was very inconsiderable, being infinitely less than I had ever before known to prove fatal.

The operation of tying the subclavian artery on the acromial side of the *scaleni* muscles is one which will be much more frequently required, and which can be performed with equal facility on the artery of either side. The most striking and most unfavourable circumstance of this operation is the length of time required to perform it, although the ultimate and essential steps of it had been executed with so much facility.

This delay is by no means unavoidable. Indeed, any man who will take the trouble of reflecting on the anatomy of the parts concerned, or who will himself perform this operation on the dead subject, must be convinced that it may be executed in as short a time as the operation for femoral aneurism. The causes of delay in this instance were, first, the almost unprecedented nature of the operation; the caution with which we tread upon untried ground rendering every incision more slow, and every step more deliberate. Next, the great anxiety to secure every vessel, even the smallest branch of an artery, or a vein, lest our view should be obscured, or our progress obstructed by any quantity of blood flowing into the wound, was a principal source of this delay. By referring to the account of the operation the reader can readily estimate that loss of time was occasioned by this object. I do not mean to say that we should pass through the various stages of the operation absolutely regardless of the flow of blood; but I am confident that we have no occasion to tie up any but the larger

veins, and the suprascapular artery, if it should chance to be wounded. The curved spatulas, while they hold aside the lips of the wound, will, at the same time, serve to stop the bleeding. I cannot forbear to recommend, in the strongest manner, the use of these instruments, not merely in this, but in every other operation where the depth of the wound is considerable, compared with its length, and where it is of importance for the surgeon to distinguish the parts which lie at the bottom of such a cavity.

The necessity for removing any portions of fat can occur only in very corpulent subjects.

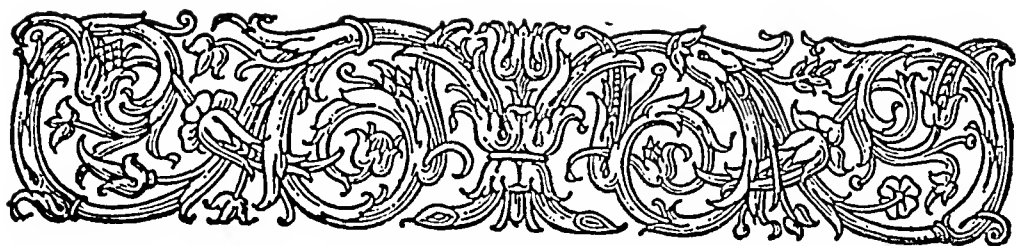
In passing the needle round the artery, it will be found absolutely necessary to have the scalenus muscle held back by one of these spatulas, otherwise it will be impossible to pass the ligature without including along with the artery some portion of the muscular fibres.

The facility with which the ligature was passed round the artery was in the highest degree gratifying to every one present. This inestimable advantage will be secured by an attention to the following points:—First, to extend the wound out towards the acromion, by which the form of it is changed from a deep cavity to a superficial wound; next, to introduce the needle on the outer or acromial side of the artery; and, lastly, to select the most favourable part of the artery. This, on inspection, will be found to be where it has just passed through the scaleni. How necessary this selection is will appear by the perusal of the account of Mr. Ramsden's operation; for he, by attempting to secure this vessel near to the first rib, or rather, as he says, at the lower edge of the first rib, found it almost impossible to turn the needle round the artery in the very narrow space between this bone and the clavicle.

Cases in which this operation may be necessary will not be very infrequent. In wounds of the axillary artery, either while it runs in front of the thorax, or while it lies along the humerus, this operation will be preferable to following the course of the wound by cutting through the pectoral muscles in the one case, or entangling ourselves in the brachial plexus, when the artery is wounded in the axilla. The pain and difficulties of the operation

above described are trifling when compared to those which must occur in following the course of these wounds.

When an aneurism of the axillary artery shall require this operation, we may indulge a confident hope that the rest of the arterial system is free from disease, as it appears to have been in two of the foregoing cases, that of Levanee and of the Rev. Mr. S.; one, where the disease arose spontaneously,—the other, where it could be traced to accidental injury. Although this operation has not yet proved ultimately successful, yet I think we should not despair. The history of surgery furnishes parallel instances of operation, now generally adopted, which, in the few first trials, failed of success.



# Syphilis in Infants

CHAPTER XIV OF

Practical Observations on the Venereal Disease and on  
the Use of Mercury

BY

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**T**HE following fact appears to me very deserving of notice—I have never seen or heard of a single instance in which a syphilitic infant, (although its mouth be ulcerated,) suckled by its own mother, had produced ulceration of her breasts; whereas very few instances have occurred where a syphilitic infant had not infected a strange hired wet nurse, and who had been previously in good health.

It is a curious fact, that I have never witnessed nor ever heard of an instance in which a child deriving the infection of syphilis from its parents has caused an ulceration in the breast of its mother. The following case when received into the hospital appeared to form an exception, but on closer enquiry this proved not to be the case. The particulars are transcribed from the hospital registry.

Anne Cullen and child, admitted into No. 9 ward, on the 19th of March, 1834, under the care of Mr. Cusack.

The child is about three months old. The extremities, the

parts of generation, the anus, and the chin, are covered with copper-coloured spots, slightly raised and smooth. The child is pale but not emaciated, its bowels are rather relaxed. At birth it was healthy and well-looking, and continued so until it was about a month old, at which time the body became covered with those spots, which were of a brighter red color than they are at present. The mother of this infant was admitted a patient into the hospital, about four years ago, for syphilis. The only symptoms she had then were pains in the bones; but about six months before that, while suckling her own child, when it was half a year old, she got a sore on the breast, near the nipple, which was soon after followed by an eruption. She stated that other women occasionally suckled her child. In a short time after the sore had appeared on her breast, she observed that the child's mouth was sore; an eruption, afterwards came out all over its body; two other children, and a girl that attended them, became similarly affected—namely, with eruption and sore throat. They were all admitted at that time into the hospital; were all salivated, and discharged cured. After this she had two children; the first about two years since. When this child was a month old an eruption came out upon its body, and in two or three weeks afterwards it died. The other child now three months old, is (with herself) a patient in the hospital. She herself says, that she never enjoyed better health than at present; her husband, also, is perfectly healthy.

## REMARKS

In this case there was a very strong presumption that the infant was infected by some of those women who were allowed occasionally to suckle her child; that, from the child, she and all the other members of the family also were infected, except the husband, who was probably infected by the mother. I say, there is a presumption that this is the manner in which the infection was conveyed, because as yet I have not seen any instance in which an infant infected by the mother communicated a venereal ulcer of the nipple to her. This case shows that parents, who are not at all conscious of any derangement of health, may yet produce a

child which shall, in a few weeks, exhibit the genuine characters of venereal disease, necessarily derived from one or both parents.

With respect to the treatment of the nurse and child, I believe that very little difference of opinion is to be found among authors or practitioners. All agree that it is desirable (even though the child alone show signs of the disease) to bring the nurse under the influence of mercury; and many assert, that this alone is quite sufficient to effect a cure of the disease in the child. To the latter part of this statement I have seen some exceptions, and I am certain that I have seen a good many cases in which the child appeared to be daily growing worse, until mercury was directly administered to it. Of this much I feel assured, that the cure of the infant will be more speedy if it be subjected to the use of mercury at the same time with its nurse. I am also disposed to think that in the treatment of the nurse we shall succeed better with small doses of mercury than with large ones. I am disposed to ascribe to over anxiety of the surgeon, and consequently to too vigorous treatment, the frequent failures, and still more frequent tedious cures, of nurses infected by syphilitic infants.

The disease, as it appears in the syphilitic infant and the infected nurse, seems to differ very little, if at all, from the secondary symptoms which result from this disease of adults, as contracted by impure sexual intercourse. But if we proceed to trace further the consequences of this infection in the nurse and in the infant, we shall discover some striking particulars in which the diseases propagated by them materially differ from the ordinary form of syphilis.

With respect to the nurse, we find that very frequently her husband becomes affected with ulcerations on the genitals; and these, in a short time, are attended by superficial ulcerations of the throat and mouth. If we have an opportunity of examining the nurse, at the time her husband first complained of ulceration of the genitals, we shall find a greater or smaller number of small raspberry-like, moist, raised excrescences, or, as some term them, ulcers, on the genitals and insides of the top of the thighs of the nurse, and this while there is no eruption on the general surface



of the skin. Every one conversant with the appearances of the venereal disease in females, knows that when they are the subject of general venereal eruptions their genitals are beset with them, and that all those on the genitals, or on the skin in contact with them, assume that raised moist condition above mentioned. But in the instance of infected nurses, we shall sometimes find that this condition of the genitals is an attendant on the affection of the throat, without the intervention of a general eruption of the skin. And here we must remark, that while spots of ordinary venereal eruption so generally fix upon the pudenda of the female, and there degenerate into those moist raised ulcers above mentioned, we see very few spots of venereal eruption on the male organs of generation; and those which are found there retain the characters of the general eruption; and indeed, we may add, are usually of the scaly nature.

The ulcers which are seen on the genitals of the husband, very closely resemble those on the pudenda of the woman; but they are not so much raised, do not yield as much discharge, and give us the idea that they are in a less moist structure or tissue. In a short time after the appearance of these ulcers on the genitals of the husband, he begins to complain of soreness of the throat, or of the lips and tongue. On inspecting these parts, we do not find the truly syphilitic ulcer; we see generally the palatine arches pretty extensively covered with a very superficial ulceration, with broken patches of whitish lymph, on and around the really ulcerated spots; a similar appearance, but more in the form of pretty large circular superficial ulcers, may be seen on the inside of the cheeks and lips. The tongue, if affected on the sides, presents appearances similar to those on the cheeks, but, if the dorsum be affected, we observe a smooth, patch, perfectly bald and polished, as if the papillae had been carried off from this spot. The common occurrence of ulceration in the throat of the nurse being attended with ulceration of the pudenda, and, on the other hand, the ulceration on the genitals of the husband being so constantly attended with affections of the throat, seem to point out some sympathetic connection between these parts, which has hitherto been overlooked. But when we come to examine more closely

the circumstances under which this apparent sympathetic connection takes place, we shall find reason to call in question this solution. For we find that such sympathy between the throat and parts in the vicinity of the anus never takes place when the former is affected with any form of ulceration, except that which is distinguished by the milky-white state of the *mucous membrane* of the throat; so that, after the most strict investigation; we are obliged to adopt the conclusion that this apparent connection is caused rather by something peculiar in the morbid condition of the part affected than in any natural or morbid sympathy between those remote parts, the seats of co-existent disease. And, in corroboration of this opinion, I observe that in every instance of such superficial white ulceration of the throat, I always enquire, and generally discover the corresponding affection of the anus; while, on the other hand, when the patient complains of the soreness of the anus, and that we there find the superficially ulcerated or excoriated state of this part, I immediately enquire for the corresponding affection of the throat; and this latter I have not unfrequently discovered when the patient was not conscious of its existence, so little inconvenience was he suffering from it. I readily admit that we may meet with instances, where only one of these parts is thus affected at the time of our examination; but if we closely attend to the progress of the case, we shall seldom (if ever) find any which, at one period or other, either in its earlier or its later stage, has not had the other accompanying it.

I must here remark, that my observation does not supply me with an instance of the husband having contracted the disease by sexual intercourse, except when ulcers had formed on the pudenda of the nurse.

Having here traced the propagation of this disease from the parents to the infant, from the infant to the nurse, and from the nurse to her husband, let us now attend to the manner in which it may be made to contaminate every other member of the same family. If we suppose, as frequently happens, that the child is suckled in the house of the wet-nurse, and that she has a numerous family of children, to one of her daughters (more particularly) is assigned the care of dressing and carrying about this infant—

this is the child which first suffers from the contamination. The whole family being completely ignorant of the nature of this disease, this girl sleeps with the rest of her brothers and sisters; for among the lower orders of Irish that family is considered to be in comfortable circumstances which can afford a separate bed for the parents, while all their numerous progeny are huddled together in another bed; the discharge from the ulcers about the anus and vagina, coming in contact with one of her brothers or sisters, will produce a similar ulcer on their persons; and in this manner, obviously, a number of the family contract the disease.

The readiness with which this disease is communicated by contact, cannot be exceeded in this property by any other disease with which I am acquainted; I look upon it as equally infectious with the itch itself. Another manner in which this disease is made to spread through the family, is by the use of the same spoon, and drinking out of the same vessel with another of the family, to whose mouth the disease may have spread. Those who are acquainted with the very scanty furniture of an Irish cabin, will readily comprehend with what facility and rapidity the disease can be propagated in this manner; but to others it may be necessary to say, that the family are quite satisfied with the possession of one single spoon, and the stock of cups and cans is nearly as scanty. Exposed thus to the double risk of contracting this infection when sleeping or taking nourishment, we cannot be surprised at finding three or four, in a family of six children, all at the same time infected.

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